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ELECTRICAL WORLD

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December 22
1934

Man's love of light has come unchanged down through the centuries. The shining star, the gleaming candle, and now the nightly scene of fairyland that marks our modern world, still warm his heart and lead him on. Light speaks the very spirit of our times and in this Christmas season renews again our faith in all that electricity stands for.

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Reader's Guide to This Issue

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THIS INDEX is merely a convenient guide. Many articles will appeal to several reader groups—many will apply to all. News and other departments are of general interest.

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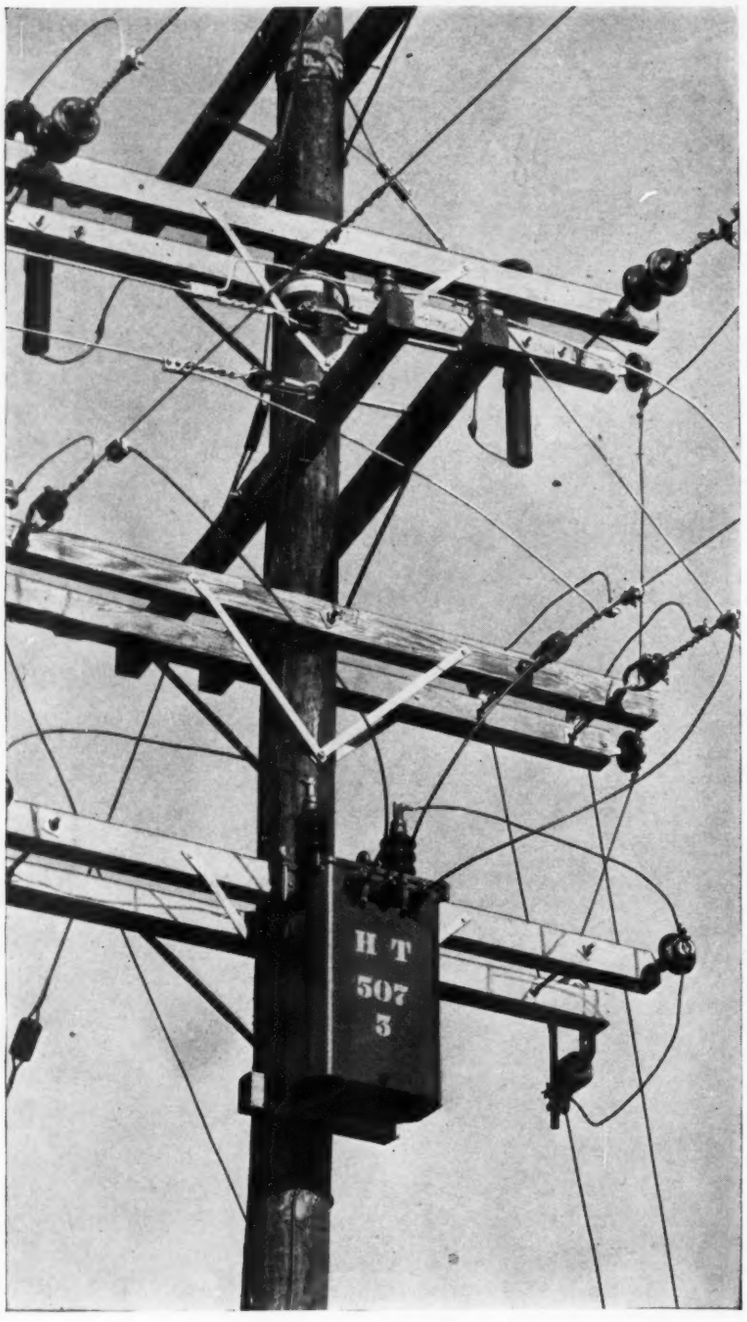

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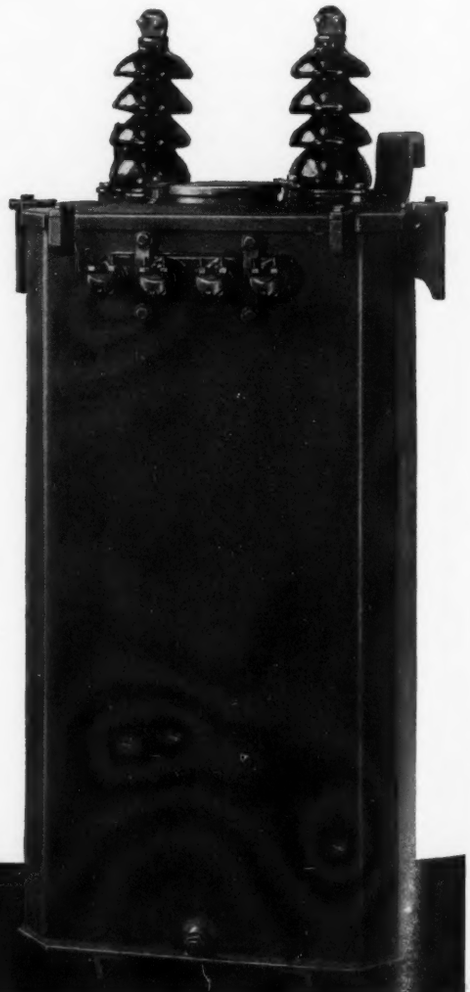

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...Trends...

As Gleaned From This Issue of "Electrical World"

▸▸ McNinch for Federal Regulation

The chairman of the Federal Power Commission talked to the state regulatory authorities recently in Washington. His address is presented in this issue and gives his ideas as to what should be done. He believes federal regulation is necessary to control holding companies. We hope he knows how greatly holding companies have changed their methods and organizations in recent months so that most if not all the reasons for federal regulation have been eliminated. With adequate state regulations there is no chance for holding companies to exploit operating properties, even if any holding company be so foolish as to attempt to do this. The Federal Power Commission has a great chance to show its honesty of purpose and helpful support to the utilities in this time of trial and we hope it will do so. The rate and power survey reports should be factual and not opinionated.

▸▸ Fast News from Electricity

There is no let-up in electrical developments. Any job of any magnitude or of any degree of precision can be done best electrically. A typical example is given in the article describing the electrical applications to high-speed news printing. Think of taking several motors and tying them together so that all act and move in unison with minute precision. Contrast this with the eight-horse teams of covered wagon days. Manufacturers and engineers will find ideas in this article applicable to other kinds of installations.

▸▸ That Deadly Darkness

The real story of the results of inadequate street lighting is a story of human accidents. The facts given by Mr. Simpson about street lighting and traffic safety in his article are appalling. Truly, as he says, the electrical industry should do something about this. It has a moral responsibility and a business opportunity. The joint work done in New Jersey should be duplicated elsewhere. All streets and all highways should be well lighted. This business confronts the electrical industry.

▸▸ Utility Operations Are Still Rising

Utility operations continue to increase. Revenue for October was 3.7 per cent more than in September, 3.6 per cent over last year's October, and amounted to $155,811,500 in sales to ultimate consumers. Only in the three peak years 1929, 1930 and 1931 did the corresponding month's income rise higher, the maximum difference being 7 per cent, in 1930. Average daily energy output was the largest for any month since early in 1931. Consumption for domestic use broke all records for the season, was nearly 8 per cent greater than a year ago and points definitely to an all-time winter peak for that class of business. More customers are being served than ever before.

What About 1935?

In the January 5 annual statistical and review number "Electrical World" will tell the story of industry operations in 1934 and expectations for business in 1935. Utilities are going to spend more money. Manufacturers will make more sales. This issue will give tangible data of immense value to all interested in the electrical business. It shows where business will be had and the type of things that will go on in the marketplaces.

▸▸ Those T.V.A. Rates

More publicity is had about the rates offered by the T.V.A. than any other aspect of the project. Of course these rates are based upon estimated ultimate costs and developments. This rate cannot be supported on present investments and loads in the valley. We are glad, therefore, to have Mr. Ostrander discuss the T.V.A. rates and the economic bases for rates in this issue. We believe he treats the subject in a sufficiently clear manner for all to understand if his article is read. And more people should know what he says, even those in the electrical industry.

▸▸ Wiring Costs Discussed

The subject of wiring equipment, methods and costs has been active since 1884 and is still active. Mr. Egan gives his opinions very frankly about the present situation in this issue. Wiring is a part of the complicated commercial and organization picture of the industry, with many groups interested and with many opinions about what can or should be done. Open discussions, continuous, open-minded study of possibilities and technological progress can be counted upon to solve the problem. The discussion by Mr. Egan deserves the serious attention of all interested in the subject.

▸▸ Cost of Pole Maintenance

Any item of maintenance where a multiplicity of units exist is difficult to place on a logical basis. This is the case with wood poles, which are a large item, if not the largest, in distribution maintenance. We are fortunate, therefore, to present an article on this subject giving a specific plan and method used in Boston. Pole manufacturers and utility distribution engineers should be able to get some valuable information and aid from this study and practice.

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ELECTRICAL WORLD

MANAGEMENT • ENGINEERING • OPERATION • UTILIZATION

PUBLISHED EVERY OTHER SATURDAY

DECEMBER 22, 1934

Washington Now Offers Co-operation

AN ENCOURAGING change in the attitude toward private enterprise now prevails in Washington. Business leaders have been invited to co-operate in the improvement of NIRA and have accepted. During the past weeks the President has reassured the utilities somewhat. He has offered to limit the extent to which the government expects to go into the power business. He has, in effect, stated the terms of a truce. He has expressed the desire to avoid litigation to fix the legality of the federal power projects. The primary basis for this changed attitude is the acquired knowledge that recovery will continue only if private enterprise prospers and creates more employment.

Despite the disappointment in the reception accorded the memorial presented by Mr. McCarter and the intrusion of the President into the New York municipal rate situation the above statements are on record. It is natural that there should be disappointment in the industry over these incidents, but the attitude expressed by the President at recent press conferences after his conversations with Messrs. Willkie, Carlisle and Arkwright should not be forgotten.

Leaders of industry have no desire to fight the government. However, they cannot agree to the violation of principles which they believe to be sound nor to the destruction of their enterprises through unfair governmental competition or destructive legislation. Their greatest desire is to bring about recovery and prosperity and they will now work wholeheartedly to help produce a constructive program to this end.

Utilities, especially, will welcome government co-operation. Their goal is the same as that of the government, to increase the electrification of America just as rapidly as is practicable. They, too, believe in the social value of electricity and have built their business on this principle. They have always agreed to the policy of expecting only a fair return upon the investment required to render the service. They believe they are most competent to electrify this country and reject the idea that it is necessary or in the public interest for the government to go into the power business.

In recent years the power "yardsticks," the power relief-projects and other governmental utility activities have injured the industry and prevented it from developing its business. These experimental projects were overpublicized, were used as propaganda that seriously affected the credit standing and public relations of the private utilities, are experimental and in the initial stages of development only and afford as yet no facts to measure any values. They were too largely accepted as accomplished facts instead of idealistic conceptions. There seemed to be no limit to federal power commitments. Recent and contemplated court actions brought matters to a crisis. The industry had to take action.

The utilities ask only for a square deal and a chance to show what they can do. They will sell their service; they will expand their facilities; they will make every effort to bring about business recovery and to extend the social benefits that accrue through electrification. They will use the limited yardsticks of the government and will use all facts they may produce that will enable them to operate better or more economically or to get more business and more employment. Electrical men believe that the electrical industry can take a major rôle in bringing about recovery and advancing social standards. Government co-operation instead of government competition will remove the greatest handicap to effective action in carrying out their plans in the public interest. This truce should be preliminary to a new deal that is a square deal for utilities.

Moccasin Power House below Hetch Hetchy Reservoir

CALIFORNIA SHIFTS FROM WATER

The general public and many politicians believe that our national power supply should be based upon large hydro stations and long transmission lines. This conception is incorrect. Out in California pioneering power development came with hydro stations and long transmission lines. Then came oil and gas. New generation in central and southern California took the form of fuel stations at the loads. Power generation at the load, with transmission lines as diversity ties, is a principle that needs to be followed in future power development. Water power has its place, but it must be co-ordinated with steam power.

Regulation at the Crossroads

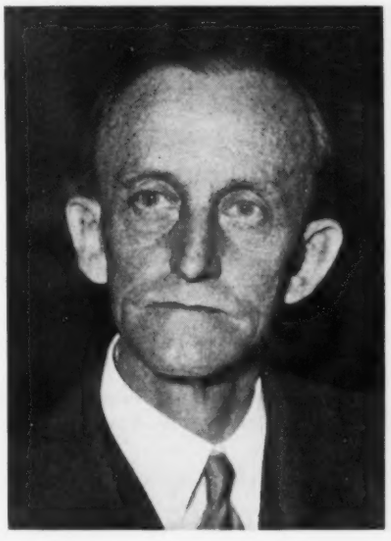
Survival Depends on Co-operation of State and Federal Agencies—No Invasion of States Rights to Be Feared

By FRANK R. McNINCH*
Chairman Federal Power Commission

NOTHING is to be gained by blinking at the facts. In my judgment the principle of regulation is today at the crossroads, because the American people are re-examining as never before our political, our social and our economic institutions. Men who are sincere and earnest, men who have thought deeply upon this problem have reached the conclusion that regulation of monopoly is impracticable and cannot be had. I do not share that view, nor do my associates share that view. Certainly you do not share that view. Then, if we do not, must we not recognize that this challenge made by serious men, by patriotic men, must be met, not by academic discussion of the subject, not by words, but by deeds, by concrete results, hammered out upon the anvil of the regulatory commissions, demonstrating to the public that we can regulate monopoly, and that the combined resourcefulness of monopoly is not greater than the power of the states and the federal government combined.

There are those in this land who have been disseminating propaganda intended to drive a wedge between the state regulatory commissions and the federal regulatory commissions, to the end that we may be weakened in our main attack upon the gigantic interests that have inspired and furthered this unworthy attempt and that have appealed to petty jealousy on the part of men holding high office and under primary obligation to serve the people.

As you know, this has been done under the false alarm of an attack upon "states' rights." I challenge them, or any one, to point a finger to anything the Federal Power Commission has done, or is doing, or is authorized by the statute to do, that affords any real ground for any such charge that any assault is purposed or intended or would for one moment be countenanced by the Federal Power Commission in the direction of an attack upon any legitimate state right.



Let us not be deceived about the attitude of the American public. What the public is demanding is results. The people are demanding vigorous action, are demanding understanding, are demanding results at the hands of the regulatory commissions. Mark my words, not because they are mine, but mark them, nevertheless, if the verdict of the public ultimately should be that the principle of regulation has failed, there will be laid at your doorstep and mine the principal responsibility for the failure.

And it will not afford us a good excuse or reason for failure if we point, as we well might point, to the almost inexhaustible resources of the power companies to defeat regulation. The challenge is that we shall match their resources with our own, with the men of our commissions to serve us ably; that we shall match their industry in studying this very technical and complex subject and not be misled by the splitting of hairs between the north and the northeast side. If there is failure we will not be heard successfully to say that we lacked the ability to match wits with the power companies. Nor will we be heard to say with success, although that can be said with much force, that the state regulatory commissions in many, many instances are denied adequate budgets with which to employ adequate personnel to cope with the power companies.

Three great undertakings in which the Federal Power Commission is engaged will be another evidence of the desire of the federal government to co-operate with state commissions, but which will mean much more than that. In my judgment, these three undertakings are going to afford the state commissions added facilities for doing a better job than we have ever had before.

I refer first to the national power survey being conducted by the Federal Power Commission under executive order of the President in August, 1933. Time will not permit me to tell you in detail what that survey is. Suffice it to say that, while in years gone by there has been some exploration of power potentialities, America has not until now ever undertaken a national

Fear of obliteration of state regulation has grown with the ascendency of the federal commissions. Complete disavowal of such intention is heartening news to the public and the electrical industry. It is also reassuring to the industry that the rate survey is purely a fact-finding study. This is not generally recognized. Chairman McNinch pledges the aid of his commission to the state commissions in eradicating the abuses of the holding companies. We are glad to be able to give these vigorous pronouncements early circulation.

*Excerpts from address at recent convention of National Association of Railroad and Utilities Commissioners in Washington. Full text obtainable from the official reporter, State Law Reporting Company, 30 Vesey Street, New York.

survey of our power resources, of their relation to the present markets, to the probable future markets, for power, the development of undeveloped power sites, as well as the co-ordination of steam and hydro, in order that there may be a well-balanced and dependable source of power for the people. We are going through this work with 75 experts.

Then there is the electric rate survey under which the Federal Power Commission is engaged with another 75 experts. This is the first national rate survey ever authorized in America. It is amazing how little there is available to us as regulatory bodies about the rates in the various communities in the United States.

Let me make it clear to you, so that there may be no misunderstanding, that the joint resolution required the commission to assemble, investigate, analyze and report all of the rates in force in America. There is nothing in it but a fact-finding commission. We have nothing to do with the regulation of rates under this resolution. There will be no recommendation about rates being high or low. That, gentlemen, is your problem, your province, your field. It will put into your hands the detailed information in respect to every rate in force in America, in order that you may study the many interesting problems, such as uniformity of rates and what not, and you may make intelligent comparison between rates in communities in your state and communities similarly situated in other states.

Then there is the third special activity, the study of distribution costs of electricity. It is a singular thing to me, novice as I am in this business or profession, that so little is known about what it does cost to distribute electricity. I find and you find that the cost of the generation of electricity may be very accurately determined, but just what it does cost to distribute electricity from the substation to the meter of the consumer, I think I am safe in saying, nobody knows, or if anybody does know he has kept it to himself as a profound secret.

I wish now briefly to address myself to a thing that strikes me as very close to the efficient administration of the law, which affects the Federal Power Commission as much as it does your commission, namely, that of the holding company in the power field. I shall speak to you as temperately as I can on this subject, but if I speak with some degree of earnestness, bordering upon intemperance, will you pardon me, because of the things that I have seen with my own eyes in the attempt to administer the federal power act.

There are those who contend that there are inherent virtues and economies in the well-regulated and administered holding company system. I shall not for a moment challenge that statement or that contention. If the American people become convinced that it is not possible to regulate the holding companies, then, in my judgment, the American people will insist upon their being abolished, because they will not tolerate any corporate existence so high and mighty and powerful that it can exact from communities profits from the consumer and at the same time assert its might and power against any attempt to regulate it in the interest of those from whom it takes these profits.

So that I say, and I believe, the holding companies, if they want to save their lives, unless they want to commit suicide, must desist from their resistance to regulation and embrace thoroughly the broad principle of complete regulation by federal and state commissions.

There is no purpose in mind, and there will be none, on the part of the Federal Power Commission to draw unto itself any regulatory functions whatever that are now administered by the states or that can be administered by the states. What we have in mind is that nobody can regulate them until there is first set up the necessary adequate and sufficient machinery by which we may compel these holding companies to produce their records and books and reveal to us all the facts pertaining to their relationship with the operating companies. When that information is made available, then it will be for the use, of course, of all who are concerned, either state or federal regulatory commissions.

There should be no division about who is going to regulate and how it is going to be done and all that. If I sense the public mind rightly about this, and I believe I do, this is no time for legal quibbling; this is no time for petty jealousies; this is no time for anything that will obstruct our progress. This is the time for action, a time for responding to the demand of the people that all regulatory bodies, state and federal, shall collaborate, shall co-operate, in order that the two forces, state and federal, may be united and present a solid front, demanding and commanding that these great holding companies shall put their cards on the table, with the face side up, so that we may see and know and understand what are the facts about their machinations.

Do you tell me the people will longer submit to a system under which, according to Federal Trade Commission reports, profits ranging from 40 to 300 per cent have been taken for services rendered by holding companies to operating companies? I tell you they will not, and you know they will not longer brook any difference between your commissions and our commission, but will insist that we proceed with a united front and charge upon these holding companies which are stifling the operating companies, taking their toll unjustly from the public consumer.

For my own part, and that of my associates, we are of the opinion that there should be a flat prohibition against any profit taking by the holding company out of the operating company for service rendered. Our position is that those economies belong to the operating companies. They furnish the business, they furnish the opportunity for the saving, and the saving should be passed on 100 per cent to the operating companies in order that they may pass it on to the consumers.

Planks in Chairman McNinch's Program

1. Full co-operation with state regulatory commissions.

2. Survey of rates on nation-wide scale to provide broader basis for local decisions.

3. Survey of power resources and demands on which to form future development program.

4. Survey of electrical distribution costs.

5. Drastic restraint of holding companies.

6. Legislation to afford access to their books and practices.

7. Prohibition of profit from holding company services to subsidiaries.

8. Curtailment of holding company intrusion into operating management.

Holland Plans High Lines

Double-Circuit Tie Lines at 100 and 150 Kv. Will Reinforce Service From Load-Center Plants

TO INSURE continuity of supply, a system of interconnections between distribution systems has been proposed for Holland that differs somewhat from the British National "Grid" System.

The latter, it will be recalled, is fed by a number of generating plants, the local distribution systems taking their energy from this grid. In the Netherlands the existing interconnecting lines as well as the projected ones are not intended primarily as a transmission network, but rather as a safeguard in case of serious damage to any one plant. Each power station is intended to supply its own area chiefly and only a serious shortage in any plant will lead to the transfer of large quantities of energy.

Holland's population, estimated now at 8,300,000, or slightly more than the whole of New England, is crowded into an area no larger than Massachusetts and Connecticut. The country is thoroughly covered with an intricate system of 10-kv. lines supplemented by a considerable network of 50 kv. and a line of 150 kv. in the extreme southern part.

Accessibility, relative prosperity and the progressiveness of the population favor the use of electricity. It is estimated that 99 per cent of the people can be supplied and that practically that fraction is actually supplied with electricity.

Most of the utilities are owned and/or operated by the several provincial governments functioning through limited liability companies, of which they hold all the shares. The Netherlands government pursues no uniform method for regulating them. In general, the provincial plants are producers only. Sales to ultimate consumers are made by the municipalities, the smaller ones buying energy from the provincial plants and the larger ones generating their own supply. The upshot of this situation is that of the 448 companies giving service, 40 are power-producing and most of them distributing concerns as well, while 408 are solely distributing companies. Output in 1931 was 1,979,000,000 kw.-hr., or 245 kw.-hr. per capita.

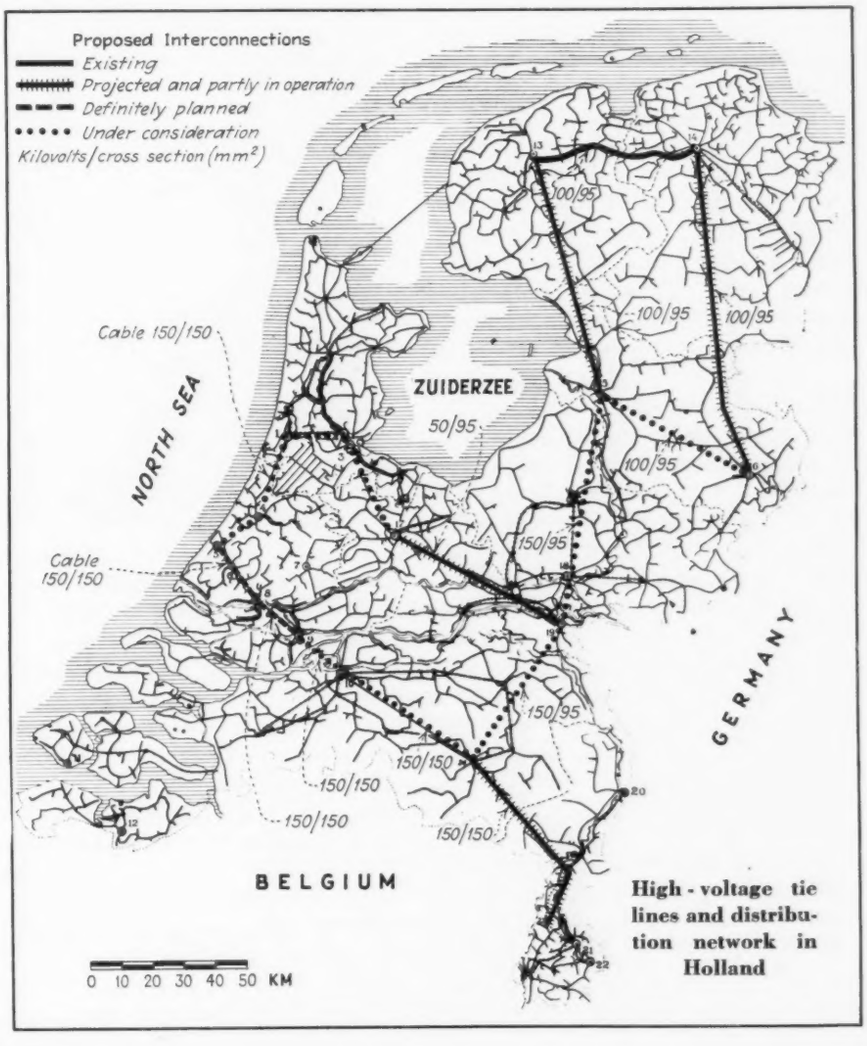
The proposed scheme of interconnections—not yet elaborated—is part of a plan of the national government to secure greater unity throughout the country. The location and voltages of lines involved in the proposed scheme of interconnection are shown on the accompanying map.

Most of the lines are double circuit, three phase. Cross-section of wires is given in square millimeters, those of 95 mm.^{2} being equivalent to 187,000 circ.mil (between No. 3/0 and No. 4/0) and 150 mm.^{2} to 296,000 circ.-mil.

Power plants and substations are designated by numerals as follows:

Plant	Kw.	Plant	Kw.
1 Velsen	48,000	13 Leeuwarden	23,494
2,3 Amsterdam	201,600	14 Groningen	40,100
4 Leiden	29,400	15 Zwolle	28,000
5 The Hague	84,000	16 Hengelo	61,000
8 Rotterdam	82,070	17 Utrecht	52,700
9 Dordrecht	41,750	19 Nijmegen	———
10 Geertruiden-berg	106,000	23 Lutterade	115,000
		24 Eindhoven	———

Very advanced practice is proposed for the Rotterdam-The Hague 150-kv. line, which is to consist either of two three-conductor cables of 150 or 240 mm.^{2} (380,000 circ.mil) each, or three single (with one spare) cables of the same cross-section; likewise for the projected circuit The Hague-Leiden-Haarlem-Amsterdam-Utrecht.



High-voltage tie lines and distribution network in Holland

A Way to Meet T.V.A. Rate

One-Cent Energy Possible With Modernized Distribution, Full-Use Consumption and a Subsidy of Some Form

Is the T.V.A. yardstick rate fantastically low? Are the privately owned utilities doomed by complete inability even to approximate it? An answer to these posers carries weight when it comes from a firm that designs and builds and knows how much system costs can be brought down. The presentation should prompt some municipalities to ascertain whether co-operation with their utilities cannot accomplish what the Administration thinks the public wants at far less outlay than competitive confiscation and wastefully duplicated facilities.

By J. K. OSTRANDER

Electrical Engineer
United Engineers & Constructors, Inc.,
Philadelphia

THE federal government is now spending a tremendous amount of money to create, according to its own statement, a yardstick for the cost of domestic electric power. Apparently the term "yardstick" is intended by the government to mean a domestic rate schedule which the majority of light and power companies should offer to their customers.

If the schedule adopted by the Tennessee Valley Authority should become the official yardstick a clear understanding of how it will be applied is then a matter of utmost importance. The following analyses of power costs indicate that in practically every community a rapid change to this schedule would be impossible without some form of subsidy to the power company. However, a rate schedule similar to that established by the T.V.A. is so desirable that it might be accepted as an ideal or par schedule which all companies would strive to reach in the shortest possible time.

The T.V.A. rate schedule permits the sale of 200 kw.-hr. per month at a cost of $4.50. In order to produce power at this cost in a system using steam generation it would be necessary that conditions be such as to make possible the following fixed charges and operating costs:

Assume a domestic customer with an annual consumption of 2,400 kw.-hr. The peak load generating capacity for such a customer might be 0.85 kw. If a new power system should be constructed to supply the domestic load a normal cost for the power system per kilowatt of generator capacity might be $100 for power stations and $175 for distribution system and customer installation, making a total of $275 per kilowatt.

Allowing for spare capacity, this might be $350 per kilowatt of peak load, or $300 for the 0.85 kw. load of the customer. The fixed charges on this investment under ordinary conditions would be somewhat in excess of 12 per cent, but if they are limited to interest, taxes, depreciation and insurance, and conditions are made sufficiently favorable, they might be brought down to 10 per cent, making the annual charge for the customer 10 per cent of $300, or $30.

The cost of energy at the power station, at approximately 3 mills per kilowatt-hour, is $7. The cost of operation of the distribution system for this customer might be $10 and the overhead expense and customer service expense, such as meter reading, billing, service calls, etc., $7. This makes a total of $24 per year for operation and, added to the $30 for fixed charges, gives $54 per year for 2,400 kw.-hr., or 2.25 cents per kilowatt-hour. This is tabulated as follows:

2,400 kw.-hr. at 2.9 mills at power station	$ 7
Operating cost of distribution system	10
Customer service and overhead expense	7
	$24
10% fixed charges on capital investment of $300	30
Total cost for 2,400 kw.-hr.	$54
Cost per kw.-hr., cents	2.25
Cost of 2,400 kw.-hr. at T.V.A. published rate, cents	2.25

Second block at 1½ cents

A similar analysis of the second block of 200 kw.-hr. per month is as follows:

A power station cost of $90 per kilowatt for large stations is quite possible at the present time and a distribution system and customer installation cost of $125 per kilowatt might be obtained for a new system designed to meet the new conditions incident to large individual customer loads. If these property costs could be obtained a 1½-cent per kilowatt-hour rate would be possible for all consumption after the first block of 200 kw.-hr. per month. This is shown from the following analysis of the cost of the second block of power of 200 kw.-hr. per per month:

Property cost per kw. of power station capacity	$215
Property cost per customer requiring 0.85 kw. of power station capacity	183
Same allowing for spare capacity	225
Power station operating expenses for 2,400 kw.-hr. at 2.5 mills	$6.00
Distribution system operating expenses	5.00
Customer service and overhead expense	2.50
Fixed charges at 10 per cent of $225	22.50
Total annual cost of 2,400 kw.-hr.	$36.00
Cost per kw.-hr., cents	1½
Cost of second block of 2,400 kw.-hr. at T.V.A. rate, cents	1

With the present state of the art, there is no item in this cost which is capable of any material reduction, even though an entirely new power

system should be created. In order to bring the cost down to 1 cent per kilowatt-hour it would be necessary to reduce the above costs one-third. While some of the cost items might possibly be reduced one-third, it is certain that all of them could not be reduced this much. This means that it is not possible, at the present time, to deliver any block of power to the domestic consumer for 1 cent per kilowatt-hour unless some form of subsidy is granted (this includes the supply of money at low interest rates) or unless the power is delivered to the customer at a time of day when the other load of the power system is small and no appreciable extra system equipment is required to generate or transmit this power. This is true regardless of whether the power is generated by steam or water power or whether the system is operated by the federal government, a municipality or a private company.

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Any domestic rate schedule which includes a power block at 1 cent per kilowatt-hour or less, without some special requirements regarding utilization, is providing for the sale of power at less than cost unless some form of subsidy is given to the company.

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It is true that a water power station may require a lower percentage of property cost for taxes, depreciation, maintenance, insurance and operating expenses than that required for a steam station, but this saving is almost always offset, to a large extent, by higher construction costs for the power station and transmission lines.

Excess block at ⅔ cent

The T.V.A. schedule permits the sale of power in excess of 400 kw.-hr. per month at 0.4 cent per kilowatt-hour. This is much too low even for an ideal or par schedule, as there is no indication that domestic power can ever be delivered to the customer at this price except at a loss. Furthermore, this price is not necessary as an inducement rate. It is also probable that the first block of 50 kw.-hr. at 3 cents is too low in proportion to the middle blocks.

If 1½ cents per kilowatt-hour be taken as the lowest reasonable rate for any block of daytime power and 2.25 cents per kilowatt-hour as determined above be taken as the rate for the first 200 kw.-hr. per month, then an ideal rate schedule, such as might be established as par at least for large urban systems, would be as follows:

	Cents per Kw.-Hr.
First 50 kw.-hr. per month	4
Next 50 kw.-hr. per month	2
All additional kilowatt-hours	1½
Hot water heating (off-peak load)	⅔

Although somewhat different from the T.V.A. schedule, it might be considered equivalent as it would produce approximately the same revenue from the customer.

A typical monthly power bill, based on the above rate schedule, might be as follows:

50 kw.-hr. per month at 4 cents	$2.00
50 kw.-hr. per month at 2 cents	1.00
133 kw.-hr. per month at 1½ cents	2.00
300 kw.-hr. per month at ⅔ cent (off-peak)	2.00
533 kw.-hr. per month at 1.3 cents	$7.00
533 kw.-hr. per month at T.V.A. rate	$7.03

T.V.A. more than met

The first $2 could be called the cost of power for lighting and small appliances, the next $1 the cost for a refrigerator, the next $2 the cost for a range and the next $2 the cost for water heating.

The above segregation of loads is not a fictitious allocation of load blocks to the various appliance usages because each block is approximately the quantity of power which that particular appliance consumes. Furthermore, appliances are generally installed in the sequence given above.

It might appear that the 2-cent rate for the refrigerator is too high in comparison with a 1½-cent rate for the range, as the refrigerator produces a load factor of nearly 100 per cent, while the range load factor may not exceed 25 per cent. The justification for this is the fact that a large part of the refrigerator load will be carried by the present high cost distribution system, while the high peak range load building up to a large volume at a later date may be carried by a new part of the generating and distribution system which it is expected can be constructed at a lower cost.

The water-heating load is almost necessarily an off-peak load, but being off-peak, as shown by the above cost figures, the ⅔-cent rate may be consistent with the on-peak rates.

It is apparent that in most cases no lower rate for any power block is necessary as an incentive for building up domestic load, and as some companies may be able to sell power at this rate at some future time, the schedule appears to be suitable as a par which many companies will strive to reach.

Time required for adjustment

The federal government is apparently convinced that such a domestic rate is extremely desirable, but this opinion is not shared by every one who has given thought to the problem. It is pointed out that the average cost of domestic power is but $33 a year, and nearly ten times this amount is spent by an equal number of families for usage of their automobiles. It is also shown that more money is spent for cigars and cigarettes in this country than is spent for domestic power. This would indicate that the amount spent for power is so small in proportion to its value that there should be no need for further rate reductions. Unfortunately this is not the whole of the story.

If the load is to be built up as suggested above, it may be necessary for the customer to purchase a refrigerator, a range and a water heater. These three devices alone will probably cost over $300, and with the cost of installation the investment may be $400, or an amount appreciably more than the company's entire property investment for serving this load will eventually become. The fixed charges on this investment should be added to the power cost in determining the customer's actual expenditure.

It seems futile to argue that the low rate is not extremely desirable, but the fact that it is desirable does not make its attainment possible. In fact, for the following reasons, it is practically impossible for any power company to reach the par rate quickly without selling at a loss or receiving some form of subsidy.

Referring to the first table the operating cost, excluding taxes of $24, might be possible under certain conditions, but, except in rare cases, no company has fixed charges as low as $30. This is due to several causes. First, interest, taxes, depreciation and insurance generally total more than 10 per cent, regardless of any effort made by the company to reduce them. Second, the property cost, even for a company operating under favorable conditions, is almost always more than

$300. This is due to the fact that although every piece of equipment when installed was the best and most efficient obtainable, much of it is now obsolete on account of the rapid development of the art. Even though the apparatus itself may be in good operating condition the system employed is probably too expensive in comparison with a newly constructed system. With few exceptions it will always be possible to replace an old power system with a new one at a lower cost. This will be especially true of the distribution system in the future. Third, the present average utilization per year is only 600 kw.-hr. per customer, but if the utilization were 2,400 kw.-hr. the load density would be four times as high and the load factor would be improved; consequently, the cost per kilowatt-hour would be less.

Instead of the $30 fixed charges for the first 200 kw.-hr. per month, they might be twice this amount for a large, well-managed power system with a fairly high average load density.

Tax elimination proposed

The determination of a plan to effect a substantial reduction of fixed charges in a reasonably short time is indeed a problem not easy to solve. However, the federal and some local governments have come to the conclusion that the following plan will accomplish the desired result:

They have constructed new power systems with the expectation that property costs would be appreciably lower than those of the existing systems. The costs, of course, should be lower regardless of who constructs them, but the combined cost of the old and new system is necessarily much greater than that of the old alone, so by this process total property costs are actually increased instead of decreased; consequently, while one group of people may make a slight gain, another group is sure to suffer a much greater loss. This plan generally involves an elimination of taxes and the supplying of money at low interest rates. Such subsidies may be highly advisable, but they should be just as effective if applied to the old system as if applied to the new one. As a modification to this plan the power company may be forced to sell all or part of its property at a price considerably below its actual cost. Obviously this process merely forces the former owners to supply a subsidy to the new company, which is a very unfair procedure.

The above plan is so seriously defective that it will probably never come into common use. If its good features, such as the reduction of taxes, could be applied to the private companies the result would be beneficial, but this concession is almost impossible to obtain, first, because political expediency prevents it, and, second, because the appeal by the power companies for a reduction in taxes generally dwells upon the benefits which this will be to the companies themselves instead of upon the benefits which it will be to the customers. Those with power to act on the appeal are unsympathetic and the general public is not interested in anything which does not offer to it a definite benefit.

Regardless of what course the companies are forced to pursue or elect to pursue, the cost of domestic power will gradually decrease as a result of an increase in usage. This will be brought about by a continual increase in the installation of refrigerators, ranges and water heaters, with the possible addition of some newly invented device requiring a large amount of off-peak load. Under present conditions a rapid increase in the use of these appliances will be greatly retarded by their high cost. A practical plan for making possible the purchase of this equipment by the average customer will be the most effective element in increasing power usage and thus decreasing rates. Most rates are now low enough so that they offer little restraint to the use of refrigerators, but they are not yet low enough to encourage the extensive use of ranges and water heaters. A little more time will be required to accomplish this result, but if the power companies receive the proper co-operation from other organizations, especially governmental groups, the time will be shortened and in many cases the attainment of the par rate schedule may be realized.

Advocates Share-the-Profit Principle

The best way, it seems to me, that a decrease in hours and an increase in wage rates can be accomplished is for each industry to establish fair compensation to all of its employees from the top executives down, one-third of the net profits for each calendar quarter, as soon as these are determined by the quarterly audited statement. From the top down each employee would participate in these profits pro rata, according to the fair normal compensation received by each. (I suggest a top limit of $1,000,000.)

This plan gives all of those connected with the enterprise, from the top executive down, an incentive, now too frequently lacking, to give the best that they have to their company. It will make it more easily possible for the business to live within its income in times of poor business. Everybody in the company will become a partner, and it will be vitally interesting to each and every one connected with it to strive to eliminate waste and incompetence and not to withhold ideas or suggestions from the management.

We have had this plan in effect in our business since June, 1931, with excellent results.

CLAUDE MATTHEWS,
Vice-President and Treasurer W. N. Matthews Corporation, St. Louis.

Energy Sales Still Mounting

October earnings were the best for the month in three years. Domestic use is setting new records, industrial power consumption turned upward.

WITH increased energy sales all along the line, the revenue of electric light and power companies in October rose 3.6 per cent over last year's figure for the same month to $155,811,500, according to the Edison Electric Institute, and made a slightly larger gain over September. It was about $9,300,000 more than in July, which was the low month of the year, and continues the improvement over 1933 that has prevailed since last January, though at a rather better rate than in the preceding four months.

Total as well as average daily energy output was not only the maximum for any month of this year, but was the largest since the spring of 1931. Production was 7,407,000,000 kw.-hr., or 5.2 per cent more than the amount a year ago, and 8.4 per cent more than in September. Water power contributed 34.3 per cent, the larger ratio compared with earlier months being attributable to the breaking of the drought which prevailed throughout the summer.

Regional analysis reveals larger revenues than a year ago throughout the country except in New England and the Southwest, with gains rising as high as 6.3 per cent in the Middle Atlantic and 7.2 per cent in the Mountain States. Compared with September there was a notable improvement everywhere except in the Southwest and Far West. It approached 7 per cent in New England and the Middle Atlantic area and 5 per cent in the East North Central.

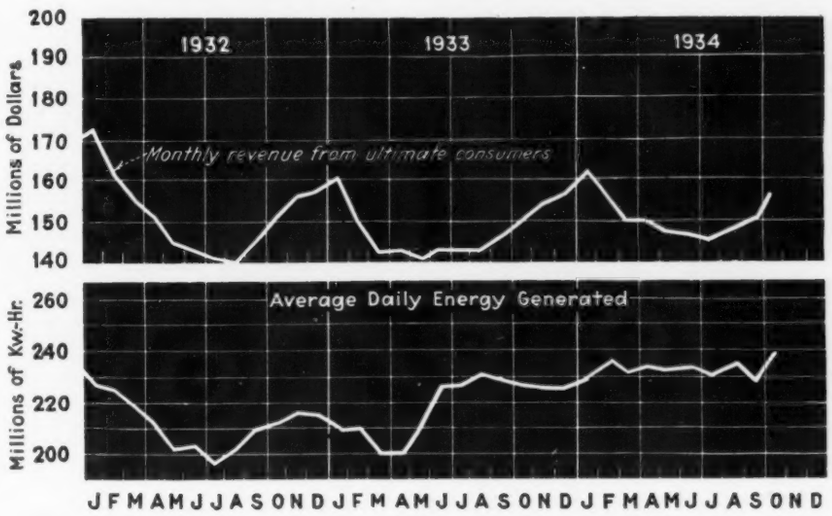

1932
1933
1934
Millions of Dollars
Monthly revenue from ultimate consumers
Average Daily Energy Generated
Millions of Kw-Hr.
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

Table I—Monthly Revenue from Ultimate Consumers and Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1934	Revenue from Ultimate Consumers		Energy Generated, Millions of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent. Inc.
October	155,811	+3.6	7,407	+5.2	2,544	+ 4.5	4,863	+ 5.3
September	150,196	+2.4	6,839	—1.0	2,272	—16.2	4,567	+ 9.0
August	148,465	+3.5	7,317	+1.4	2,339	—13.3	4,978	+10.3
July	146,529	+2.3	7,176	+2.3	2,427	— 7.3	4,749	+ 7.8

Table II—Regional Revenue and Energy Output in October, 1934

Compared with Corresponding Month of Previous Year

Geographical Region	Revenue from Ult. Consumers		Energy Generated, Millions of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.
United States	155,811	+3.6	7,407	+ 5.2	2,544	+ 4.5	4,863	+ 5.3
New England	13,198	—0.1	513	— 1.8	203	— 1.0	310	— 2.6
Middle Atlantic	46,491	+6.3	1,900	+ 5.1	481	+ 1.0	1,419	+ 6.7
East No. Central	34,560	+2.0	1,745	+ 5.2	179	+43.1	1,566	+ 2.7
West No. Central	13,397	+4.0	464	+ 5.8	91	+ 2.7	373	+ 6.5
South Atlantic } East So. Central }	19,684	+3.8	855	+ 5.2	509	+29.0	346	—17.5
			336	+27.6	276	+33.0	60	+ 7.1
West So. Central	8,417	—1.8	378	+ 2.4	7	+17.5	371	+ 2.2
Mountain	4,579	+7.2	245	+ 2.2	165	—15.3	80	+76.4
Pacific	15,485	+4.3	971	+ 5.0	633	—14.2	338	+81.4

*By courtesy of U. S. Geological Survey, with deductions for operations not regarded as central station.

Record domestic use

Energy consumption for domestic use continues to climb to new high levels, again surpassing 1,000,000,000 kw.-hr., with a larger October figure than in any other year, an increase of nearly 8 per cent over 1933 and 6 per cent over September. Wholesale power sales, which normally trend downward at this time of the year, broke the rule with a 3 per cent rise from September, although this can be partly explained by the decline in that month due to the textile strike.

Continued expansion of service is indicated by the addition of 67,000 customers during the month and a net gain of 560,000 in the twelve-month period. Pre-depression records were exceeded some time ago. During the past few months new ones have been established only to be broken by the next set of figures. The latest total is 24,767,255, domestic 20,441,774.

For the twelve-month period the average domestic rate dropped to 5.32 cents per kilowatt-hour, against 5.51 cents a year ago; annual use rose from 604 to 626 kw.-hr.

Table III—Allocation of Energy, October, 1934

Compared with Corresponding Month of Previous Year

Class of Service	Millions of Kw.-Hr.	Per Cent Inc.
Total for distribution*	7,385	+ 4.1
Lost in transmission, etc.	1,397	+ 6.3
Sold to ultimate consumers	5,988	+ 3.6
Domestic	1,081	+ 7.8
Com'l, small light and power	1,112	+ 4.1
Com'l, large light and power	3,142	+ 2.4
Municipal street lighting	194	+ 1.4
Railways—street, interurban	353	+ 6.3
Railroads—electrified steam	59	+ 1.4
Municipal and miscellaneous	47	—22.1

*Generated, purchased from other sources, imported, less energy used in railway and other departments.

High-Speed News Printing

One-Fifth Accuracy in Page Cut-Off Attained by Speed-Linked Coupling of Individual Drives on Press and Folder Units

By W. L. WRIGHT
Industrial Engineering Department,
General Electric Company
Schenectady, N. Y.

INDIVIDUAL motor drive has been applied in the field of high-speed rotary web newspaper presses in an endeavor to obtain greater flexibility in drive or unit combinations. While the idea of individual unit drive sounds practical, the problem of a satisfactory tie-in or means for keeping the individual motor units in synchronous relation without the aid of interconnecting shafts and gearing seemed difficult of solution. It was fully realized that unless these mechanical parts could be entirely eliminated the mere application of a group of small motors tied in with a common equalizing shaft offered no advantages over the double motor group drive now commonly used and would result only in a more expensive and cumbersome arrangement.

Guided by the rich experience gained by many years of design and manufacture of electrical drive equipment for sectionalized paper machines, which is found to have many operating characteristics common with the modern newspaper press, an all electrical tie-in system was devised and tried out on an existing press normally arranged for two-motor group drive.

This installation consisted of five individual motor drives arranged for parallel operation, each incorporating an electrical synchronizing means and arranged for chain connection to a sprocket mounted on the first impression cylinder shaft of each press unit and on the folder shafts of an octuple press geared for a top speed of approximately 50,000 papers per hour.

The electrical tie-in medium incorporated in this new drive system consists essentially of a separate induction type Selsyn unit built integral with each driving motor.

The Selsyn unit comprises a primary or stator winding and a secondary or rotor winding, each phase wound and inductively related. The secondary terminals are brought out to collector rings for connection to a common bus. When placed in proper phase relation and mechanical position of pre-register with respect to a group of similar elements and energized simultaneously from a common source of alternating-current power, these Selsyn units have the property of locking synchronously in step and when driven by their respective motors will start simultaneously and rotate in synchronism. Any unbalance in power between the various driving motors of such a group is equalized electrically through the Selsyn units causing an interchange of energy to or from the drive that tends to run slower or faster than the remainder of the group.

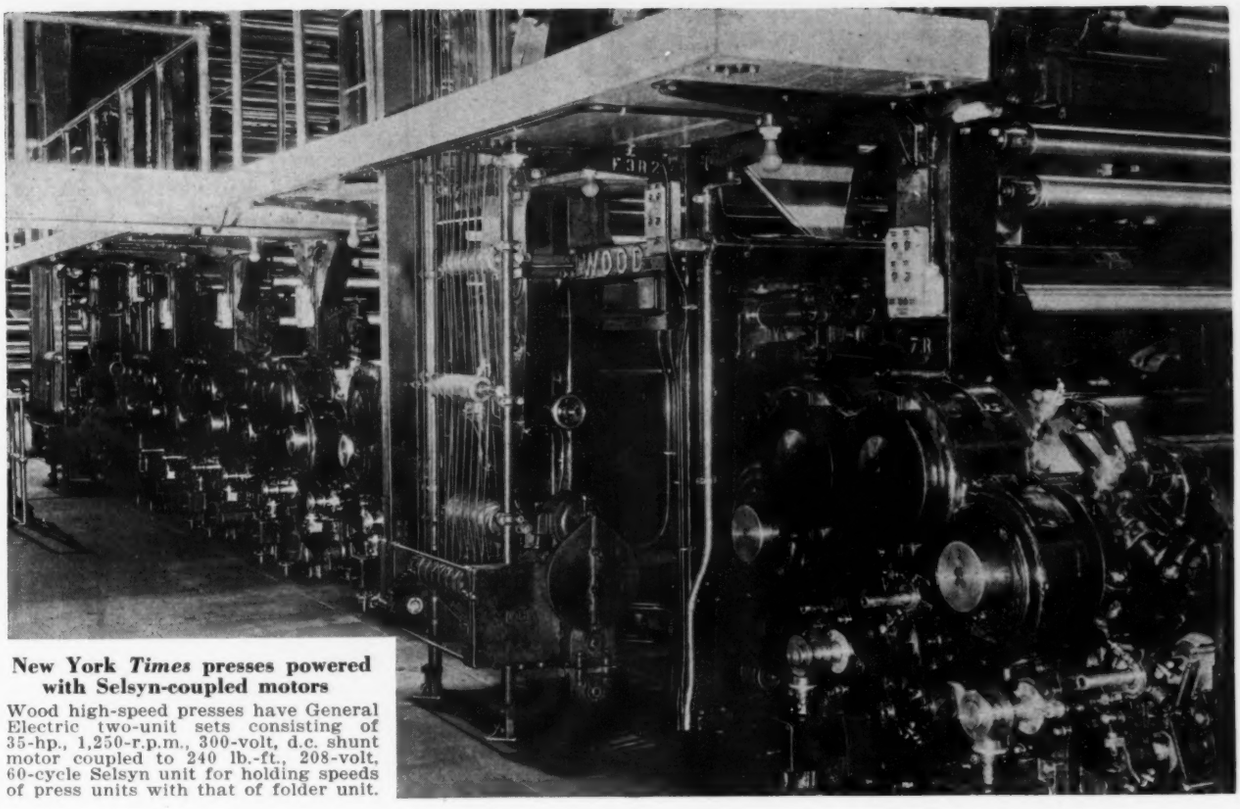
Precision of register and margins on a rotary web press running octuples at 50,000 per hour is an accomplishment. The New York *Times* does it with Selsyns applied to the individual drives. In running 40,000,000 copies there has been only one web break for each 42,632 copies. It all proves that Selsyns have moved out of metering into full-grown industrial power jobs.

While it will be appreciated that with such a system of electrically synchronized rotating elements it is necessary to produce a relative angular displacement of the respective rotors for the development of a differential tie-in torque, this degree of angular displacement for any application is entirely within the control of the electrical designer.

Four degree angular displacement

The ultimate design for this application called for identical Selsyn elements, of approximately the same normal torque rating as the driving motors, constructed along standard wound-rotor induction motor lines with eight-pole windings for 208 volts, three-phase, 60-cycle excitation supply. For a given value of shaft torque the angular displacement of the Selsyn rotor in mechanical degrees varies inversely with the number of magnetic poles, therefore a proper selection of the number of poles is important.

The eight-pole Selsyn units, which have proved entirely adequate for this application, develop 100 per cent tie-in torque with an angular displacement of approximately 4½ mechanical degrees. This rotor displacement, when referred to the circumference of the printing cylinder in the inverse ratio of the chain drive, neglecting mechanical variances, is approximately two-tenths of an inch and represents the possible shift in the margin cut-off of pages printed from a given unit, if the Selsyn is called upon to furnish all of the driving power because of failure of the d.c. driving motor. This shift might easily be compensated for by the usual means provided on the press. Under normal operating conditions, however, the average load unbalance between units is found to be



New York *Times* presses powered with Selsyn-coupled motors

Wood high-speed presses have General Electric two-unit sets consisting of 35-hp., 1,250-r.p.m., 300-volt, d.c. shunt motor coupled to 240 lb.-ft., 208-volt, 60-cycle Selsyn unit for holding speeds of press units with that of folder unit.

from 5 to 10 per cent of the top speed motor rating, thus the actual tolerance in margin cut-off, neglecting any mechanical variances, is quite negligible, being from 0.01 to 0.02 in.

As a matter of record, the Selsyn system of tie-in on individual press units, as developed for the initial installation and in subsequent applications, has successfully demonstrated the effectiveness of the tie-in under extremely adverse conditions of load unbalance, including heavy winders and frozen press bearings to the point of breaking the shear pins in the driving sprocket without dropping the units out of step.

Electrical consumption low

The total energy consumed in such an electrical tie-in system from the alternating-current power source is the magnetizing loss of the Selsyn elements, approximately 1½ to 2 kw. per unit. This value remains practically constant regardless of speed or the amount of energy transfer between units. The relatively small rotational losses of the machine are supplied by the respective driving motors.

The drive for each press unit and folder consists of a 35-hp., 1,250-r.p.m., shunt-wound, direct-current motor, mounted on the same shaft with its respective Selsyn element, forming a two-bearing unit, arranged for a 3:1 ratio silent chain drive to the first impression cylinder shaft of each unit and to the folder shaft. The driving motors for any press combination are designed to operate in parallel with fixed field excitation and receive power from a common adjustable voltage bus. This method not only provides the utmost refinement in speed control, but is also well adapted to alternating-current power supply, making use of a synchronous motor-generator set, involving relatively high efficiency and capacity for power-factor improvement.

The field excitation of the driving motors, main generator, synchronous motor and certain control elements is obtained from an exciter, which forms a part of the motor-generator set.

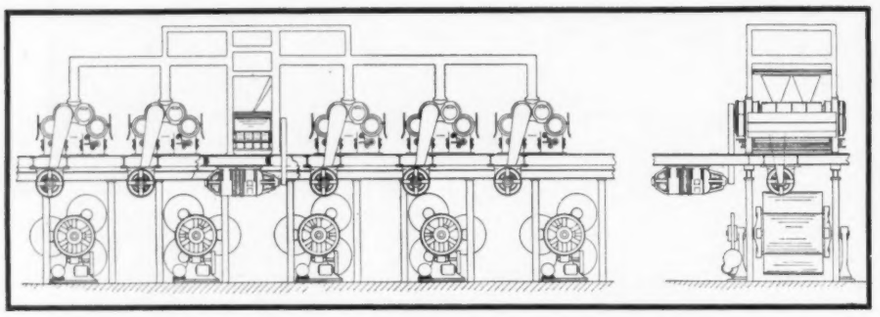
To obtain suitable voltage characteristics of the adjustable voltage generator and permit of inching the press for plating and maintaining an extremely low speed (approximately 2½ per cent of full speed), for threading in the webs, the series exciter method of automatic voltage regulation is employed. The series exciter has the characteristics of automatically regulating the voltage impressed on the motors, when acting on the main generator field. This automatically compensates for the total resistance drop of the armature circuit and thereby stabilizes the voltage, resulting in a very uniform low speed regardless of comparatively wide variations in load torque.

Series exciter gives uniform threading speed

When starting a press from rest a relatively high value of motor armature current is necessary to overcome static friction and to accelerate to threading speed. This current falls rapidly from about 150 to 30-40 per cent at threading speed. Hence, to prevent an overshot in threading speed a voltage change must be obtained at a corresponding rate. The series exciter in combination with the main generator and driving motor has been found to meet all application requirements, being extremely flexible and subject to wide ranges of adjustment, depending upon the number of driving units associated in a given combination.

Speed control above threading speed is obtained by adjusting the impressed voltage on the driving motors by generator field control and the series exciter then becomes inactive.

The control equipment for such a system of individual motor drive with Selsyn tie-in is of the full automatic type arranged for push-button operation. It consists essentially of one main generator panel and an auxiliary selector panel for each of the driving



D.c. shunt motor and Selsyn-tie units drive first-impression cylinder shaft through silent chains

units preferably located adjacent to the units. All functions of press operation are obtained from any one of several push-button stations conveniently located at the press, which provide for "fast," "slow," "jog," "stop," "safe-run" operations.

The main generator panel carries a pilot-motor-operated combination master switch and generator field rheostat which provides for the necessary sequence of control functions and speed adjustment. An auxiliary rheostat provides for adjusting the series exciter for starting torque control and also a similar rheostat for adjusting the threading speed of the drives as may be required. In addition to the main line contactor, dynamic braking contactor, series exciter shunt contactor, necessary interlocks and relays, this panel carries the main a.c. supply contactor for Selsyn control.

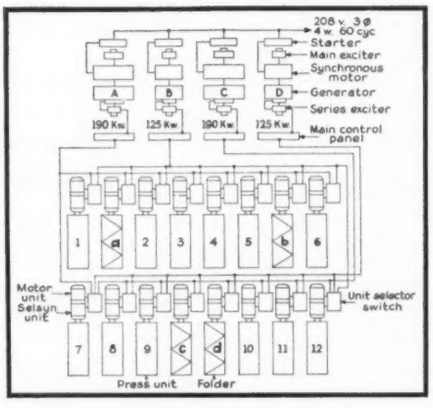
The scheme of control provides for the establishment of the Selsyn tie-in before power can be applied to the driving motors, and conversely the Selsyn system remains energized for a sufficient time interval after power has been removed from the driving motors to insure that the press is at rest before breaking the tie-in medium. This insures a positive tie-in of all press units at standstill as well as at running speeds. A recent modification of this system includes a series reactor in the a.c. supply designed to leave approximately one-half voltage on the Selsyn system while at standstill. This prevents the possibility of any slight mechanical displacement of the printing units when relieving the normal stresses set up in the chain and gearing at the moment of de-energizing the Selsyns. This value of excitation is sufficient to give the relatively small amount of tie-in torque for such a condition and reduces the losses at standstill. Full voltage, however, is applied at the time of starting the press.

Many combinations are possible

Selection of press units for predetermined combinations with the respective folders is accomplished at selector stations located adjacent to each press unit. These selector stations are in the nature of master switches which not only provide for the operation of the power transfer switch for the driving unit, including the Selsyn elements, but also provide for the transfer of all press control circuits, including push button, signal and protective circuits to the corresponding main control panel. The normal arrangement usually provides for the association of each press unit with either of two folders, or the equivalent of two sources of power for each individual drive, thereby making available a large variety of press combinations for normal and emergency operation. When the desired selection is made, colored lights on the press indicate the source of power service or the generator supply and that the proper control circuits have been established.

In view of the fact that the various units are mechanically independent, the system requires that each printing unit be placed on its predetermined mark for proper registration with other units and the folder with which it is associated. In this initial setting the Selsyn elements are automatically placed in proper polar relation and become locked in step as soon as excitation is applied.

As a further refinement, the unit control system provides for independently jogging any press unit for plating or threading, by means of a lock switch incorporated in each selector station. The operation of this switch automatically locks out the control to the other units of the combination and allows only the unit in question to be moved. When the jogging operation is finished the unit is simply jogged into registration with the adjacent units, the lock switch is closed and the press is again ready for operation.



Many combinations possible for different page assemblies

Sextuples		Octuples	
1-a-2-3	Gen. A	7-1-a-2-3	Gen. A
4-5-b-6	Gen. B	4-5-b-6-12	Gen. B
7-8-9-c	Gen. C	8-9-c-10-11	Gen. C
d-10-11-12	Gen. D	**Double sextuples**	
Decuples		1-a-2-3-4-5-6	Gen. A
1-a-2-3-4-5	Gen. A	7-8-9-c-10-11-12	Gen. C
7-8-9-c-10-11	Gen. C		

Two banks of six press units equipped

As a result of the successful performance of the developmental unit motor drive system tried out in 1931, this type of drive was subsequently adopted by the New York *Times* for its new Wood high-speed presses at the West 43d Street plant. These drives were installed on two adjacent rows of presses, each row consisting of six press units and two folders arranged to operate as four sextuples, three octuples, two decuples or two double sextuple combinations. For octuple combinations the web from the end units of one row are carried across by means of angle bars to combine with the webs from the units in the adjacent row, thereby making it possible to use all twelve press units for three independent presses, without any mechanical connections.

This equipment was placed in service in April, 1932, and has been on regular production schedule since May. Its excellent performance may be judged by the pressroom report for the first four months of operation, showing a total of 589 runs, consisting of eight quadruples, 178 sextuples, 146 octuples, 154 decuples and 106 double sextuple combinations, with a total net production of approximately 40,000,000 copies. The average web break over this period was one for every 42,362 papers printed.

Since this time another similar group of presses with the same type of drive has been placed in successful operation in this plant.

Chest Type Refrigerators

How We Have Used Them to "Sell the Customer Up" to Standard Models and Build Up Minimum Bill Consumers

By P. E. McCHESNEY
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SOME of the manufacturers and distributors seem to feel that the chest-top refrigerator "just shouldn't be talked about." Our experience has certainly taught us differently. Refrigerator sales in this area were disappointing in July. The introduction of the "Liftop" model in August aroused new interest in refrigeration. More people visited our salesroom and the salesrooms of the dealers in the territory we serve to view this new refrigerator than ever before. It gave the salesmen an excellent opportunity to "sell the customer up" on a cabinet type refrigerator if the customer could afford it.

The Liftop refrigerator has definitely increased the sale of standard types. Dealers sold 225 this August, against 85 in 1932 and 89 in 1933 for the same month. All cabinet types. Of course, times were better, but that was a small part of it. This company sold 388 refrigerators in August, of which 261 were chest types. During September we sold 110 Liftops and again the dealers sold more standard models than the year previous and so did we. It was the same in October, when we sold 60 Liftops.

So we have sold a total of 431 Liftop refrigerators and our activities commenced about the second week in August. Our newspaper advertising has been comparatively small, all of it done during the month of August. We have also been busy since that time pushing ranges, and Liftop sales have been the result of interest aroused and kept alive by the enthusiastic acceptance of the users.

It really takes salesmanship to market the chest type refrigerator. First of all, they are being sold to customers who heretofore have felt that they just couldn't afford electric refrigeration. It was something they desired, but believed beyond their means. We placed Liftop models on each dealer's floor and paid him a commission on any sales that he might make for us. At that time the other manufacturers had not produced their chest type refrigerators and we did not want to have any advantage over the dealer because his manufacturer could not supply him.

The dealers were not so enthusiastic about the Liftop refrigerator being introduced in the territory. We told them it made no difference to us whether they sold this refrigerator or not, but to please keep it on display in their stores so that we might include their names in our newspaper advertising in order that their prospects could come to their stores to see this model rather than to ours. If the dealers wanted to tell the prospects that they were not any good or too small, it was all right with us, providing they could sell the prospects their standard cabinet type refrigerators.

Since that time other manufacturers have produced their chest type refrigerators. We purchase them from the distributors, put them in our warehouse and furnish the distributors' dealers with our standard contract forms, so that when their salesmen sell their make of chest type refrigerator a contract is drawn up between our company and the customer. The dealer then passes the contract to our company and picks up the refrigerator. We in turn pay the dealer a commission which represents the difference between his cost of the refrigerator from his distributor and the cash selling price.

This plan is working out very satisfactorily. I have not included the number of chest type refrigerators the dealers sold because it is comparatively small, but the dealers are satisfied with the arrangement. The real reason that the dealers are not selling more of the chest type models is that they pay their salesmen on a commission basis and the commission on this type of refrigerator is small.

We have gone over the list and find that the majority of purchasers are laborers and people with small incomes and naturally small users of our electric service. That is the real reason that we are so enthusiastic over the possibilities of the chest type refrigerator. Heretofore, we felt that we might be able to sell this type of customer a vacuum cleaner or perhaps a washing machine, and that is about all.

Salesmen must use their intelligence in placing these refrigerators. One salesman went to the owner of a small house which had long been for rent to get him to purchase one and advertise the house as equipped with electric refrigeration. He secured permission to offer to set a refrigerator in the vacant house, provided that if we proved to him the refrigerator had rented the house he would purchase it.

A Liftop refrigerator was installed in the house at 11 o'clock in the morning and at 2 in the afternoon the owner called the salesman and gave him a check for the refrigerator, telling him that he had rented the house for $5 a month more than he was asking without the refrigerator.

There are many interesting cases. Experience has certainly proved to us that chest type models offer a most excellent opportunity to sell more than twice as many kilowatt-hours each month to many customers that are now using our service in a limited way.

Cost of Pole Maintenance

A Method of Studying the Costs of Replacement, Stubbing and Extension of Life by Butt Supports

A METHOD of determining the economy of different procedures in pole maintenance has lately been worked out by the Edison Electric Illuminating Company of Boston under the direction of T. H. Haines, superintendent of distribution. It takes into consideration the cost of replacement with or without the use of stubbing or commercial mounting and reinforcing devices and is useful in determining the procedure to be followed, giving due weight to anticipated local conditions. The method applies to poles wholly owned by the company, but can be extended if desired to joint poles.

In determining the equivalent annual cost of the average 35-ft. pole used on the Boston Edison system the initial cost and each item of maintenance expense with accrued interest compounded annually are added cumulatively over the expected period of service at the pole location. This total sum is the same as would result if the money expended had been deposited in a bank at the same intervals.

The costs resulting from the analysis are shown in Figs. 1 and 2. Fig. 1 shows the annual cost for four maintenance methods of a 35-ft. pole with creosoted butt, starting with a new pole. Obviously, the results in any particular case will depend on the local costs and conditions involved and assumptions made as to average costs, but these costs are or should be well known to each power company. In presenting this material the intent is primarily to illustrate a useful method rather than to deduce relative values of pole maintenance procedures for general application in the industry.

The costs used in making the two figures were obtained by using the following formulas:

(1) $P_n = P(1 + r)^n$, where
P = principal at start
n = years at interest
r = interest rate expressed as a decimal (0.06 here)
Pn = principal plus accumulated interest after n years

(2) $$A = \frac{rP_n}{(1+r)^n - 1} = \frac{rP(1+r)^n}{(1+r)^n - 1}$$

(3) $$C = \frac{r}{(1+r)^n - 1}\left[P(1+r)^n + P_1(1+r)^{n-t_1} + P_2(1+r)^{n-t_2} + P_3(1+r)^{n-t_3} \ldots . - S\right]$$

where

A = an annuity which if deposited at interest will accumulate to P_n after n years.

In applying these formulas to pole costs P = cost of installing the pole at the start, n = the required years of service at the pole location and r = the interest rate (not including maintenance and depreciation).

P_1, P_2, P_3, etc., = the cost of successive maintenance operations during the life of the pole installation, such as replacing the pole, installing pole butt supports, stubbing, etc.

t_1, t_2, t_3, etc., = years between installation of pole and application of the main-

Successive Steps in Pole Replacement With Cumulative and Annual Costs

Item	Time	Item Cost	Cumulative Cost	Salvage Less Removal Cost	Net Cumulative Cost	Equivalent Annual Cost
Installation new 35-ft. pole	0	$42.50	$42.50	$16.50	$26.00	$26.00
Interest 5 years	5		56.87	16.50	40.37	7.16
½ salvage disappears	5		56.87	8.25	48.62	8.63
Interest 5 years	10		76.11	8.25	67.86	5.15
Salvage disappears	10		76.11	—6.50	82.61	6.25
Interest 15 years	25		182.40	—6.50	188.90	3.44
Pole replaced	25	50.00	232.40	16.50	215.90	3.94
Interest 5 years	30		311.00	16.50	294.50	3.72
½ salvage disappears	30		311.00	8.25	302.75	3.83
Interest 5 years	35		416.19	8.25	407.94	3.66
Salvage disappears	35		416.19	—6.50	422.69	3.79
Interest 5 years	40		556.96	—6.50	563.46	3.64
.....	40		556.96	—7.50	.....	....
Interest 5 years	45		745.34	—6.50	751.84	3.53
.....	45		745.34	—6.50	.....	....
Interest 5 years	50	50.00	997.43	—6.50	1,003.93	3.46
Replace pole	50		1,047.43	16.50	1,030.93	3.55
Interest 5 years	55		1,401.70	16.50	1,385.20	3.51
½ salvage disappears	55		1,401.70	8.25	1,393.45	3.54
Interest 5 years	60		1,875.79	8.25	1,867.54	3.50
Salvage disappears	60		1,875.79	—6.50	1,882.29	3.53
Interest 10 years	70		3,359.25	—6.50	3,365.75	3.48
Interest 5 years	75		4,495.44	—6.50	4,501.94	3.46

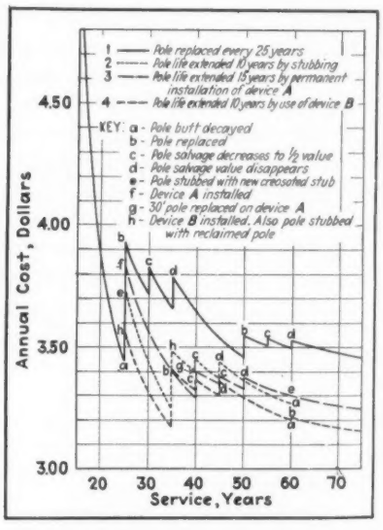
1 —— Pole replaced every 25 years
2 —— Pole life extended 10 years by stubbing
3 —— Pole life extended 15 years by permanent installation of device A
4 —— Pole life extended 10 years by use of device B
KEY: a - Pole butt decayed
b - Pole replaced
c - Pole salvage decreases to ½ value
d - Pole salvage value disappears
e - Pole stubbed with new creosoted stub
f - Device A installed
g - 30' pole replaced on device A
h - Device B installed. Also pole stubbed with reclaimed pole
4.50
4.00
3.50
3.00
Annual Cost, Dollars
20
30
40
50
60
70
Service, Years

Fig. 1—Annual cost of average 35-ft. pole for four maintenance methods

This chart shows the progressive cost variations per year of straight pole replacement, stubbing, and the use of two butt-supporting devices. Following through a typical case, that of straight replacement, it will be seen that the average annual cost determined on an annuity basis with a 6 per cent interest allowance drops rapidly with a new pole until, at 25 years' life, it is replaced.

The replacement cost raises the average from $3.44 to $3.94. During the next five years it is assumed that the salvage value of the pole decreases 50 per cent. At the 30th year the average cost has become $3.72. At the 35th year, when it is assumed that ten years' life has caused all salvage value of the second pole to have disappeared, the average cost of pole operations has dropped to $3.66, and the destruction of salvage value increases this to $3.79. From this time forward, with replacements every 25 years and reduction of salvage values as indicated, the average cost trends downward.

tenance operations P_1, P_2, P_3, etc., respectively.

S = salvage value of installation at n years less cost of removal.

C = equivalent yearly pole cost over a period of n years.

Assumptions Made

Installation Costs	Round Numbers
Install average 35-ft. pole	$42.50
Replace average 35-ft. pole including changing over of construction	50.00
Install Device "A"	32.00
Install Device "B"	16.50
Stub pole with new creosoted stub	16.00
Stub pole with old pole	6.00
Replace pole on Device "A"	36.00
Replace pole using Device "B"	40.00
Assumed Lives	**Years**
Pole in ground	25
Old pole on Device "A"	15
New Pole on Device "A"	10
Old pole after applying Device "B"	10
Stubbed pole	10
Units of Devices "A" and "B"	100
Salvage Values (cost of removal is deducted)	**Round Numbers**
Treated pole 0-5 years old	$16.50
Treated pole 5-10 years old	8.25
Treated pole over 10 years old	—6.50
Treated pole on Device "A," 0-5 years old	24.00
Treated pole on Device "A," 5-10 years old	17.50
Treated pole on Device "A," over 10 years old	4.50
Pole fitted with Device "B"	3.50
Stubbed pole	—7.00

Basis for Cost and Salvage Values

Installation of average 35-ft. pole assumed to carry four 6-pin arms, six No. 4 wires and one street lighting bracket:

	Cost to Install	Cost to Replace
Pole, 10 hours install, 10 hours replace	$16.67	$16.67
Four 6-pin arms, 2 hours install, 4 hours replace	5.20	5.20
Six No. 4 wires, 3 hours install, 4.2 hours replace	.....	.....
Street lighting bracket, 3 hours install, 3.5 hours replace	.....	.....
Four angle-irons, 1.2 hours install, 2.4 hours replace	2.00	2.00
19.2 hours at 85 cents installation labor	16.30	.....
26.1 hours, replacement labor, at 85 cents	.....	22.20
Truck, 3 hours at 75 cents, installation, 4 hours replacement	2.25	3.00
Totals	$42.42	$49.07
Cost to install Device "A"	$31.36	
Cost to install Device "B"	$16.27	

Cost to Stub Pole	New Creosoted Stub	Old Pole Used for Stub
11-ft. creosoted pine stub	$7.00	.....
Old pole, 2.5 hours	.....	.....
Trucking from treating plant	0.20	$0.20
Galvanized stubbing clamps	1.90	1.90
Through bolts, two ⅝ x 14-in.	0.18	0.18
Labor, 6 hours at 85 cents	5.10	.....
Labor, 8.5 hours at 85 cents	.....	7.23
Truck, 2 hours at 75 cents	1.50	1.50
Totals	$15.88	$11.01

Cost to Replace 35-Ft. Pole Already Equipped with Butt-Supporting Devices	Device "A"	Device "B"
Pole, 3 hours Device "A"; 13 hours Device "B"	$12.82	$16.67
Four 6-pin arms, 4 hours	5.20	5.20
Six No. 4 wires, 4.2 hours	.....	.....
Street lighting bracket, 3.5 hours	.....	.....
Four angle-irons, 2.4 hours	2.00	2.00
Labor, 17.1 hours Device "A" at 85 cents	14.53	.....
Labor, 27.1 hours Device "B" at 85 cents	.....	23.05
Truck, 2 hours at 75 cents	1.50	.....
Truck, 4 hours at 75 cents	.....	3.00
Salvage value of Device "B"	.....	—10.15
Totals	$36.05	$39.77

Salvage Value of Treated Pole	0–5 Years	5–10 Years	Over 10 Years
Pole, 2 hours	$16.65	$8.33	$0
Four 6-pin arms, 2 hours	5.20	5.20	0
Remove six No. 4 wires, 1.2 hours	.....	.....	.....
Remove street lighting bracket, 0.5 hour	.....	.....	.....
Four angle-irons, 1.2 hours	2.00	2.00	1.00
Labor, 6.9 hours at 85 cents	—5.86	—5.86	—5.86
Trucking, 2 hours at 75 cents	—1.50	—1.50	—1.50
Totals	$16.49	$8.17	—$6.36

Salvage Value of Treated Pole on Device "A"	0–5 Years	5–10 Years	Over 10 Years
Pole, 1 hour	$12.82	$6.41	$0
Four 6-pin arms, 2 hours	5.20	5.20	0
Pole Device "A" 2 hours	12.25	12.25	12.25
Remove six No. 4 wires, 1.2 hours	.....	.....	.....
Remove street lighting bracket, 0.5 hour	.....	.....	.....
Four angle-irons, 1.2 hours	2.00	2.00	1.00
Labor, 7.9 hours at 85 cents	—6.72	—6.72	—6.72
Truck 2.5 hours at 75 cents	—1.88	—1.88	—1.88
Totals	$23.67	$17.26	$4.65

Salvage Value of Pole with Device "B"	
Pole, 2 hours	$0
Device "B" 0.5 hour	10.15
Four 6-pin arms, 2 hours	0
Remove six No. 4 wires, 1.2 hours	.....
Remove street lighting bracket, 0.5 hour	.....
Four angle-irons, 1.2 hour	1.00
Labor, 7.4 hours at 85 cents	—6.29
Trucking, 2 hours at 75 cents	—1.50
Total	$3.36

Salvage Value of Stubbed Pole	
Pole and stub, 2.5 hours	0
Four 6-pin arms 2 hours	0
Remove six No. 4 wires, 1.2 hours	.....
Remove street lighting bracket 0.5 hour	.....
Four angle-irons 1.2 hour	1.00
Labor, 7.4 hours at 85 cents	—6.29
Trucking, 2 hours at 75 cents	—1.50
Total	$—6.79

An examination of Fig. 1 shows that the average annual cost of a 35-ft. carrying pole in a permanent location (50 years or over) is about $3.50 per year if the pole is replaced every 25 years. If the pole replacement is delayed by the application of stubs or butt-supporting devices the annual cost for the same pole is about 25 cents per year less, representing a reduction in the cost of operating the pole plant of about 7 per cent.

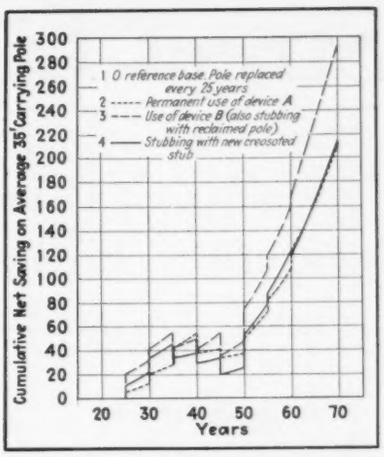

Fig. 2—Cumulative net savings of four methods of pole maintenance

An investigation reveals that stubbing with selected poles removed from the system was almost equal in economy to the use of Device "B," but the inadequacy of supply of such poles and the inferior appearance when installed rule out this method.

The small differences in economy by the several methods indicates that a study should be made by each power company to determine whether local costs and freight rates will throw the balance in favor of one or the other methods. A difference of only $2 or $3 in the cost of stubbing or using a butt-supporting device is enough to shift the order of advantage.

In cases where stubbing is proved to be most economical it cannot be as generally applied as another method which is less unsightly. The Boston company believes that pole stubbing should be limited to such locations in streets and country roads where they are never placed within 100 ft. of lawn frontage. In the best residential areas it may be considered inadvisable in many cases to use any type of butt support on account of appearance. The latest types, however, are so inconspicuous that no adverse reactions should be expected in any but the expensive single-residence areas, if at all.

The cost advantage of butt supports is increased with each increase in pole height and transfer cost. The advantage decreases as the pole height and weight decrease, so that pole replacement is probably preferable for short poles with single gains.

Street Lighting, Traffic and Safety

Findings of a Three-Year Survey — Presented in a Recent Address Before Illuminating Engineering Society in Baltimore

By R. E. SIMPSON
National Bureau of Casualty and Surety Underwriters

A THREE-YEAR survey on street-lighting costs and automobile fatalities has been made in a number of American cities. The object was to find out what effect, if any, the varying levels of street illumination as reflected by the costs had on the automobile fatality rate.

The three-hour period from 5 p.m. to 8 p.m. and the four summer months of May, June, July and August and the four winter months of January, October, November and December were chosen because the variables, other than visibility, which might affect the comparison are reduced to a minimum. Throughout the three years the returns are consistent in showing that cities with the lowest per capita costs for street lighting have the highest night automobile fatality rate per hundred thousand population, while the cities with the highest per capita cost for street lighting have the lowest night automobile fatality rate.

Table I gives the pertinent facts. In 1932 there was a slight increase in the per capita street-lighting costs and also a slight decrease in the percentage of winter months fatalities over the summer months fatalities. In the 1933 returns a large number of cities show a rather drastic reduction in their street-lighting budgets over former years. But there is uniform increase in automobile fatalities during the four winter months—more than 50 per cent higher than 1932 and 156 per cent higher than the four summer months of 1933. Also, with a per capita street-lighting cost of $1.09, the excess economic loss per capita was $0.93 in 1932. These figures are almost exactly reversed in 1933, the per capita street-lighting cost being $0.94 and the excess economic loss $1.07. The conclusion to be drawn is that the community pays for good street lighting whether it gets it or not.

Admittedly the three-hour period from 5 p.m. to 8 p.m. is the busiest of the day and for this reason the comparison between summer and winter months may not be considered equitable. Police records permitted a comparison of the period from 5 a.m. to 7 a.m. for both winter and summer months. This two-hour period is one of darkness in winter and daylight in summer and is one of light traffic the whole year. Out of a total of 203 fatalities during this two-hour morning period 64 occurred during the summer months and 139 during the winter months, and once more the winter or night fatality rate is more than double the day rate. The Travelers Insurance Company made an investigation on a nation-wide basis of the number of fatalities occurring during the four evening rush hours of 5 p.m. to 9 p.m. with the number of fatalities during the four morning rush hours of 6 a.m. to 10 a.m., and found that the fatalities in the evening rush hours exceeded the record of the morning hours by 281 per cent.

One group of cities increased its street-lighting budgets 11 per cent, or 9 cents per capita, and experienced a 25 per cent reduction in night fatalities and an economic saving of $2.07 per capita. The other group reduced its street-lighting budget by 14 per cent, or 19 cents per capita, and suffered a 7.6 per cent increase in night fatalities at an economic cost of 69 cents per capita. It is intended as soon as the 1933 costs can be assembled to continue this comparison.

It is gradually dawning on the power companies that they have at least a moral responsibility to do something to help stem the appalling loss of life now caused by automobile traffic. Some 31,000 people were killed on the highways last year, half of them at night. One-third of the night fatalities could have been prevented by adequate lighting. Here is the kind of evidence that is fast building up a case for better lighting on the highways.

Co-operative traffic counts

Through the co-operation of the police departments, the electric light and power companies, National Safety Council locals and the opportune aid of federal authorities in C.W.A. activities, traffic counts and street-lighting data were obtained from 30 cities. From these data the relation between traffic flow, street-lighting and automobile fatalities has been determined. Under the code of the Illuminating Engineering Society traffic has been classified in Table II as A, heavy traffic on thoroughfares that usually carry a maximum of more than 1,500 vehicles per hour in both directions during the lighting period; B, medium traffic with 800 to 1,200 vehicles per hour, and C, light traffic of not more than 500 vehicles per hour. Street lighting is classified as grade A when the equipment provides 80 or more lumens; grade B, 40 to 80 lumens; grade C, 25 to 40 lumens, and grade D, less than 25 lumens per lineal foot. Similarly, traffic conditions have been reduced to the common unit of million vehicle miles (m.v.m.) per year.

It is seen that the bulk of the experience comes from streets in the heavy traffic class; the average day fatality rate per million vehicle miles in this class is 0.25, while the night fatality rate increases as the grade of street lighting goes down. Specifically, the night fatality rate per m.v.m. on these heavy traffic streets with grade

Table I—Comparison of Three Years' Street-lighting Costs and Street Safety

	1931 46 Cities	1932 227 Cities	1933 60 Cities
Population	23,355,000	40,669,000	31,745,000
Cost of street lighting	$27,199,000	$44,718,776	$28,700,000*
Cost per capita	1.07	1.09	0.94*
Automobile fatalities 5 p. m. to 8 p. m., summer months	366	505	287
Add 10 per cent due to winter weather and road-surface conditions	36	50	28
(a) Number to be expected in winter	402	555	315
(b) Number actually observed in winter	794	1,025	735
Number due to insufficient light (b − a)	392	470	420
Increase winter over summer, per cent	117	102	156
Non-fatal automobile accidents 5 p. m. to 8 p. m., summer months	9,516	13,130	7,462
Add 10 per cent due to winter weather and road-surface conditions	951	1,313	746
(a) Number to be expected in winter	10,467	14,443	8,208
(b) Number actually observed in winter	20,644	26,650	19,110
Number due to insufficient light (b − a)	10,177	12,207	10,902
Excess economic loss, winter over summer	$31,707,000	$38,031,000	$33,966,000
Excess economic loss, winter over summer, per capita	1.25	0.93	1.07

*Estimated on incomplete returns.

A lighting is seven times higher, with grade B lighting nine times higher, with grade C lighting thirteen times higher and with grade D lighting sixteen times higher than the day fatality rate. Again, as in the case where costs alone were considered, the fatality rate increases as the level of street illumination decreases, but here we have taken into account part of the traffic exposure—the pedestrian exposure not yet included.

A somewhat surprising feature is that on class B and C streets the day fatality rate is almost double the day rate on class A streets—just contrary to what might be expected. This may be accounted for in part by the fact that these streets are consistently narrower by from 8 to 20 ft. than grade A streets. With parking on one or both sides there is less space and time for maneuvering in emergencies and there is the further probability that the speed does not conform to the conditions. This and the limited experience available to date may also account in part for the consistently higher night rate. The one bright feature is the showing of grade A lighting on class B streets, wherein the night fatality rate is the lowest of all. Finally, there is the total traffic exposure of more than 660 m.v.m., in which the night fatality rate is almost ten times higher than the day rate. All of which may give justification for the cynical observation that any one mindful of his own safety should not place too much confidence in our street lighting.

A further comparison has been made of the "before and after" comparison of the accident records on suburban highways as differentiated from city streets. On the new Mount Vernon Highway between Washington and Mount Vernon the lights were in service from the opening of the highway until July 1, 1933. Thereafter all lights were cut out of service. A number of 24-hour traffic counts were made in 1932 so that the day and night traffic could be segregated. There were no traffic counts in 1933, so perforce we used the 1932 counts for 1933. Records were kept so that the number of day and night accidents were readily determined. A similar condition existed with respect to the Saw Mill River Parkway and Hutchinson River Parkway in Westchester County, New York. The comparative results are shown in Table III.

When the lights on these three highways were cut out of service, primarily because of lack of funds, it was felt that the illumination provided by automobile headlights would serve the requirements of safety. The accident record portrayed above tends to show that the present type of automobile headlights falls far short of producing the degree of visibility or ability to see necessary for safe night driving under present traffic conditions. In fact, the whole trend of this survey leads to the conclusion that illumination on even our best-lighted streets is not adequate for safe driving at present speeds. Or, conversely, we must modify our habits of driving and particularly our speed if we are to achieve even a modicum of improvement toward public safety at night.

Table II—Relation Between Traffic Flow, Street Lighting and Automobile Fatalities

Traffic	Lighting	M.V.M. Day	M.V.M. Night	Fatalities Day	Fatalities Night	Fatality Rate per M.V.M. Day	Fatality Rate per M.V.M. Night
A	A	94.4	27.4	25	48	0.26	1.75
A	B	222.0	62.4	57	138	0.25	2.21
A	C	29.5	6.5	6	22	0.20	3.34
A	D	57.1	12.2	11	44	0.19	3.66
B	A	8.5	3.0	4	5	0.47	1.66
B	B	54.1	15.0	28	54	0.51	3.60
B	D	39.9	10.2	10	51	0.25	5.00
C	B	4.5	1.1	2	7	0.44	6.24
C	C	4.6	.6	2	5	0.43	8.19
C	D	9.9	3.1	5	19	0.50	6.11
Composite		524.5	141.5	150	393	0.28	2.77

Table III—Motor Accident Record During the Hours of Darkness

Mount Vernon Highway

July 1, 1932 to December 1, 1932	All lights in service
Number of million vehicle miles	3.13
Number of accidents	9
Number of accidents per m.v.m.	2.87
July 1, 1933, to December 1, 1933	**All lights out of service**
Number of million vehicle miles	3.13
Number of accidents	22
Number of accidents per m.v.m.	7.02

Saw Mill River Parkway and Hutchinson River Parkway

January 1, 1933, to July 1, 1933	All lights in service
Number of million vehicle miles	7.9
Number of accidents	59
Number of accidents per m.v.m.	7.54
January 1, 1934, to July 1, 1934	**All lights out of service**
Number of million vehicle miles	7.9
Number of accidents	81
Number of accidents per m.v.m.	10.25

One of a Series of Intimate Talks with Industry Executives

Egan on Wiring Costs

An Interview by

EARL WHITEHORNE

BACK in 1926 there arose a ruction in the electrical industry over the cost of wiring. The N.E.L.A. wiring committee went on the warpath. The contractors took down their squirrel guns and said: "Come on!" Finally the manufacturers and wholesalers were called into an industry wiring conference to help determine whether or not wiring costs were holding back the development of the industry. The conference decided that the plaintiff hadn't made a case. The defense had. But that didn't settle the argument because, though costs were known, their influence was all a matter of opinion.

Now comes the New Deal driving for universal home electrification. The power companies are under pressure for lower rates and the manufacturers for lower appliance prices. It is inevitable that the cost of wiring should again be on the carpet, for this is the third element of expense that confronts the customer when you try to sell electric service—especially cooking. And cooking load is the "white hope" right now.

Out for the Facts

So while the power industry is trimming sails to ride the storm by reducing domestic rates, it is also trying to figure out what can be done to lighten the ship, by throwing overboard all possible excess wiring expense. And the man who has taken on this figuring job is Louis H. Egan, president of the Union Electric Light & Power Company of St. Louis. He has volunteered because he wants to know. But the fact that he happens to be president of the Association of Edison Illuminating Companies gives him plenty of reason for finding out. He has gone into it with characteristic energy and enthusiasm to get something done.

Mr. Egan's attitude is very clear cut. "I have been studying this wiring situation for some time to find out what it is all about," he said in a recent talk I had with him. "I am impressed with the fact that the National Electrical Code lacks tolerance toward improvements in the art and flexibility for adjusting current wiring practice to them. The technical men who represent the insurance underwriters, inspectors, laboratories, contractors and manufacturers have so focussed on the maintenance of established rules that they have been unsympathetic to outside viewpoints. And this is not unnatural. The insurance interests are defending safety. The manufacturers are defending production standards and facilities. The contractors believe in their methods and materials.

"But meanwhile times have changed and the future of the entire electrical industry hangs upon the rapid development of a greater domestic market. And the cost of wiring has become vital. Therefore, I believe that the greatest single need within the industry today is for a closer co-ordination between electric light and power companies and all these other interests, to the end that we may find the way to make wiring less expensive and get more of it installed without sacrifice of safety.

"We have got to meet the problems of change as they come along. I am a farmer—at odd times. I am convinced that one of the principal troubles with agriculture today is that automobiles and tractors do not reproduce themselves, do not enrich the ground and eat no corn and oats. So the farmer pays out his cash for equipment and fertilizer and raises too much grain and it has thrown the whole operation out of balance. Our operation is now out of balance also, and we can't expect to reduce both rates and appliance prices and have the public feel right about the high cost of wiring. It isn't right. And we have got to face whatever adjustments must be made. We must find less costly ways to wire houses if we are to see any early expansion of the business of the electrical manufacturers, contractors and utilities."

Work it out ourselves

Mr. Egan realizes that this problem of wiring costs cannot be corrected by any one national association or any one branch of the industry. If all groups are involved in it, all must assist in finding the answer. Even the fire insurance companies realize that something must be done, because they are large owners of utility securities. They know that only increased revenues and earnings will restore these security values. And the matter cannot wait long, because Uncle Sam is apparently in this electrification adventure up to his gray whiskers and has been asking why it costs so much to connect up ranges and wire small homes and is already on the hunt for cheaper forms of wiring. And Egan comments: "Isn't it better to work it out for ourselves?"

"I have been encouraged by our experience here in St. Louis," he said. "Our people and the inspectors and the city department men have really got acquainted and come to understand each other and conditions that were wrong are being righted. It seems to be easy when we sit down together to do things for the public. And I believe it will be the same way when all these interests so concerned with wiring forget their traditions and take hold of this problem, just determined to find methods and materials that will make wiring less expensive and still safe.

"After all, it just gets down to this," he summed it up. "The way to sell electricity is to make it easy to buy and then sell a lot of it. We know this. We have known it for a long time. And the wiring people ought to be willing to help with the selling."

LOUIS HENRY EGAN, president of the Union Electric Light & Power Company of St. Louis and of the Association of Edison Illuminating Companies, who, having lowered rates and redoubled selling efforts, now raises the banner for less expensive wiring methods and believes the industry can find the way

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Plan Now and Buy Now

ENERGY output of the utilities is steadily approaching an all-time-peak magnitude. Budget returns from both utilities and manufacturers indicate an expansion in capital expenditures and sales of at least 15 per cent in 1935. National policies and general business conditions are favorable for this increase in business and the active promotion of the idea of more electrification for homes and industry by many agencies is increasing the possibilities for electrical expansion. It is our opinion that the estimates of both the utilities and the manufacturers for prospective business is ultra-conservative.

This electrical industry has always anticipated an increase in business, and it is important that it continue this policy now. Practical business and financial plans should be developed and commitments should be made for the purchase and installation of the necessary facilities to take care of the expected business. It takes time to place an order, to manufacture, to install and to get into operation major heavy-duty electrical equipment. Stocks of standard equipment are at a minimum level. Neither the utilities nor the manufacturers desire a peak buying condition, with consequent delays and wastes, and each should co-operate now in getting a good load factor on purchase and production. Nor can this industry afford to awaken in the near future to find a demand for service which cannot be satisfied.

Money for expansion can and will be had when the public demands service, but it can be obtained even now, although it is logical to use the best and most economical methods in financing. Many utilities can get money directly by issuing securities. In other cases terms and possibly financial support must be made available through other channels. Use of the principle of the equipment trust and of the method of the financing corporation might well be investigated. Now is the time for buyers and sellers to get together to work out these business problems and to make commitments at once so that facilities will be available when needed at the lowest possible cost. This industry must keep ahead of the demand.

Fair Statements Deserve Fair Consideration

THE memorial by Thomas N. McCarter to President Roosevelt was a strong statement of the present condition of electric utilities. It gave facts and offered wholehearted co-operation in bringing about recovery and in correcting any abuses or bad practices that may exist in the utility business. It was a reasoned and logical presentation to develop better relations between the utilities and the government. It deserved serious study and a considered reply.

It received neither. The immediate reply of Chairman McNinch was not in the spirit of the memorial, nor did it answer any questions raised except that asking for co-operation in legal adjudications on some of the points involved in federal power projects. The offer of co-operation in a recovery program, the offer to work out together any changes in practices that seem unwise, the request for a constructive announcement of the Administration's intentions with respect to private utilities, the request that the government cease or limit its unfair competition in power supply—these were passed over without consideration. Instead, the opportunity was taken to make irrelevant comparisons of rates here and in Canada and to scold and condemn the entire industry as being behind the times.

Mr. McNinch should not have been the spokesman for the Administration. A reply from the President himself would have measured up to the opportunities to reconcile conflicting points of view and interests of the greatest importance to national welfare. There should be no differences between the Administration and private utilities when all facts and policies are presented fairly, and this incident should not be taken as an indication of the Administration's present attitude toward utilities.

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National Resource Planning

NATIONAL planning on a large and co-ordinated scale is recommended in the report of the National Resources Board. It points out the errors of the past in developing these resources and makes suggestions that deserve careful study. The base of the report is the conservation and intelligent development of all national resources, but it goes further. It suggests that these developments should be made to contribute to the social and economic assets of the nation.

In its discussion of hydro-electric power the report just touches upon fundamental ideas and states that an elaboration of them will come from the power policy committee. The committee grants that hydro power usually cannot compete with fuel-generated power, but it states that government development can take a broader and longer view than a consideration of cost and return. It recommends careful studies of water resources and

hydro development possibilities and especially a study of costs and cost allocations for these projects. It states that a reduction in power costs will result in a wider use and a greater use. It believes that transmission and interconnection to tie all generating units together offers greatest possibilities for cost reductions.

In these contemplated studies the report states that the government will not fail to consider the present investments of the power companies, but intimates that there are many conflicting interests to reconcile, and a study must be made to determine facts and to fix the interests that should have preference. In other words, the parts of the report dealing with electricity and with the electrical industry consist of observations and suggestions only that are difficult to interpret in tangible terms. The industry, therefore, as well as the National Resources Board, "awaits with lively interest the recommendations which the power policy committee will lay before the President in due season." All agree to the fundamental idea of co-ordination and planning suggested in the report and with the suggestions for starting the studies.

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A Practical Rate Matter

HUGH WHITE, chairman of the Alabama Public Service Commission, is outstandingly recognized among regulators as one devoted to a sense of justice and fairness. When the T.V.A. invaded his state he and his associates believed such a federalized corporation should recognize the sovereignty of Alabama on a plane of parity with the private companies already there. That would just be a matter of orderly decent procedure to avert roughshod trampling by an overzealous group of Shermans headed for the sea. The stand had nothing to do with a remembrance of the wonders performed by the power and industrial empire builders who pulled the state out of a half century of desolation left by the carpet baggers who came after the hell of war had faded away.

Acknowledgment of that great contribution of power to Alabama might well have influenced the commission, but that story has hardly ever been told. The Alabama commission was merely expecting it could deal with the confronting situation on a plane of factual equity and fairness.

The sovereignty of that commission has not been granted and now jubilation in the T.V.A. chambers at Knoxville can readily be imagined when the Alabama board is forced by public sentiment to issue a call for the utilities to come in and discuss the bases on which they could bow to the unfair competition confronting them by the underselling and subsidized rates of the new "empire builders." Theories can wait, and facts may be stated, but conditions are practical and insistent. The commission faced the prospect of being accused of standing on technicalities to protect the utilities. They called the meeting to protect the sovereignty of Alabama if that can be done in the face of this kind of invasion. Oriental merchants have to have meetings of that kind once in a while to determine how much each shall ante toward the fund that the bandit marauders have demanded.

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Another Approach to Minimum Consumers

MINIMUM bill domestic customers are thorns in the flesh of the power industry right now. They do not pay their way. They are a source of expense to the utilities instead of paying a profit on the service they receive. They represent half the total number of residence consumers in some cities. A large system may have as many as 250,000 of them. It is no joke. Neither is it one of those necessary evils that must be suffered like the traditional fruits of original sin.

Much painful thought has been applied to the problem of building up the load in these homes. House-to-house canvassers have rung unending doorbells selling flatirons, toasters, cookers, portable lamps and larger bulbs, with beguiling inducements in the form of easy payments. But there is always the obstacle that you are asking them to buy, and buying means spending money. And there the process jams.

Minimum bill customers are like anybody else. They have every normal appetite for convenience, comfort and luxury, but they haven't any cash. They are schooled in the Spartan spirit of economy. They turn a heart to the visiting salesman that is harder than Pharaoh's. And so a courageous canvasser must work to convert two of these small liabilities per day into a puny profit. But what are they among so many?

The experience of Atlanta, Cleveland, Beaumont and other cities in campaigning with the small chest type refrigerator to minimum bill consumers raises an interesting question. Wouldn't more be accomplished by changing the whole approach? Canvassing to sell small appliances to these unprofitable customers is not getting anybody very far. Why not rent them chest type refrigerators? Offer something of major household importance and of great present popularity that doesn't involve a direct purchase. Avoid conflict with the organized defense against the salesmen that every family maintains today. Give them the opportunity to enjoy for a small monthly rental the modern electric refrigerator that they have long wanted. And then, in a year, convert it to an easy-payment sale.

It will probably be no harder to sell a rental contract for a small refrigerator than to sell a study lamp or a cooker. But when one is sold it brings load enough to balance several more unprofitable accounts still unregenerate. The easiest thing to interest people in is something they already want, and the important point is to get them to using more electricity. Once the use is established the appliance is not so hard to sell.

Power Topics in the Limelight

President sees leaders — McNinch takes to radio and acts as spokesman on McCarter memorial — Roosevelt discusses power at press meetings

The power question is a center of interest in Washington these days. The President saw Floyd L. Carlisle, Wendell L. Willkie and P. S. Arkwright last week and at his press conference gave a rather clear indication of his power policy. He is decided in his endeavor to lower rates, he is not for government ownership but will develop the authorized yardsticks. He stated that his discussions had been entirely amicable and that, in his opinion, the general utility problem was largely a question of fact relating to the capital needed to supply power generally and the rates required to give a fair return on this capital. Apparently he favored the prudent investment theory of capitalization. He found utility leaders receptive to discussions along these lines and intimated that a truce could be arranged that would involve a cessation of litigation and a discussion of rate reductions and capitalizations.

Another development was the very broad and idealistic report of the National Resources Board with power treated so broadly that interpretation is difficult, although the inference is that the government should control and coordinate all power generation and possible transmission. The subordinate report of the committee on power policy is expected soon and awaited with interest.

McNinch's radio address

Chairman McNinch of the Federal Power Commission gave a radio address that stressed past practices of the utility industry and reiterated the determination of the Administration to develop its yardsticks and force rate reductions. He said the government's program had "opened a wide door of opportunity to the power industry. If it has the vision to see and the bold enterprise to advance into this wider domain of public service it will find millions of new customers as well as millions of old customers using more electricity."

On Monday Thomas N. McCarter presented a memorial to President Roosevelt and this was turned over to Mr. McNinch, who replied on the same day. Full text of this memorial and the reply are given.

At the Wednesday press conference President Roosevelt was asked several questions in regard to the utilities. He stated that the federal government had no yardsticks definitely in mind besides Boulder Dam, the St. Lawrence, Muscle Shoals and the Columbia River. In response to a question, he said the statement of Mr. McCarter did not represent the attitude of the utility interests he had conferred with. He stated that if New York City asked for a P.W.A. loan to construct a power station for its own needs the application would be considered on the same basis as the application of any other self-sustaining project and that the government made or bought power at its navy yards on the basis of relative cost.

In high administration circles it was stated that people generally had perhaps fallen into the error of lumping all utility securities. Insurance companies and savings banks hold, in almost all instances, underlying bonds of operating companies and 98 per cent of these bonds, it was held, were sound—as sound as a government bond. Where there is water it is not in all the securities, but in the financial structure of holding companies. It was said the issue was beclouded by lumping all utility stocks in the same category.

McCarter Memorial Protesting Power Projects

I appear before you as president of the Edison Electric Institute with the approval of its board of trustees. This organization is the trade industry representing a very large proportion of the electrical current generated in this country. I do not come in any spirit of antagonism, but I am filled with anxiety over the grave crisis which now confronts this industry, and in this state of mind I reflect the opinion of the many thousands of persons who are employed throughout the land by this industry in one capacity or another and by a multitude of investors who see the safety of their life savings in jeopardy.

This industry is one of the major industries of the land. Its progress during the last fifty years, starting at zero to its present state of development, has been almost magical, and it has been one of the most substantial factors in the enormous development of the country which has taken place within that period of time. There is invested in it some twelve billions of dollars by many millions of direct investors, and indirectly by many millions more through the ownership of the securities of these properties by life insurance companies, savings banks, fire insurance companies and other corporations.

Investment interests wide

There is hardly any citizen of this country possessing any qualities of thrift who is not either directly or indirectly interested therein. The life insurance companies of the country hold approximately $1,651,000,000 of the securities of these electric companies; the savings banks and trust companies hold $2,000,000,000. The companies composing this industry practically without exception are operating subject to thorough-going regulation by state-constituted tribunals. An overwhelming percentage of the business of the companies is intrastate as distinguished from interstate, under the definition of these respective kinds of commerce laid down by the Supreme Court of the United States.

Since the coming of State regulation, which has had an average existence of approximately twenty-five years, all that these companies have sought to earn, or have been allowed to earn, is a fair return upon the capital devoted by them respectively to the service of the public. This has been the yardstick generally applied by the State tribunals, and it has only been in plain cases where this rule has not been applied that the Supreme Court of the United States has set aside rate decisions as confiscatory.

During the meteoric growth of this industry the holding company developed as a vehicle of financing. In the main it has been a necessary and useful instrument and should continue to be so.

Some abuses in 1920s conceded

It is true that in the period of frenzied finance and in the era of wild speculation in the years immediately preceding and ending in 1929 abuses and acts which cannot be defended crept into the manipulations of certain conspicuous holding company structures to the detriment of the public and the industry, but these were the exception and not the rule, and these abuses, except in the rarest of instances, did not involve the doings of operating companies.

Looking back upon the speculative era, we find that the follies of the day were not confined to any particular industry. The entire country lost its economic equilibrium and was off its financial balance. The nation, and the whole world, too, for that matter, is now paying the bill for this orgy of speculation in the serious depression which is now in its fifth year. The most extraordinary and vigorous measures are being taken and vast outlays of public money are being spent to bring the country out of this depression and to restore normal business conditions.

Is it fair, or is it helpful to this great objective to single out any one industry, or any two or three industries, and visit upon it or them alone destructive punishment?

Can the doubt and fear created by such a policy, both within and without an industry, fail to have its effect upon the body politic at large in creating uncertainty and anxiety, with a consequent retarding effect upon general recovery? What the power of government can do to one industry can likewise be visited upon any other form of business. No industry will be free from this devastating possibility.

Rates are defended

The claim is made that rates, and especially rates to domestic consumers, are too high, notwithstanding the fact that throughout the country they are very generally as prescribed, after careful hearing, by State tribunals clothed with rate-making powers. Rate making is a science and rates should be so arranged that, so far as possible, each class of customers, small and large, pay the fair cost of the service rendered to them respectively. There are certain fixed costs and charges in connection with serving any customer, large or small, which have to be provided for. This explains the seemingly high charges per kilowatt-hour for the first small number of kilowatt-hours of consumption. Even then the very small customers do not pay the cost of serving them. After these costs are absorbed, the cost of supplying increased kilowatt-hours falls rapidly.

The great field for lower rates lies in increased consumption, the effect of which is to give an average low rate for all consumption. Rates cannot be uniform in different sections of the country, where conditions are radically different. Their proper fixation depends upon the size and density of the territory served; the differing costs of labor and material; the freight rates involved; the taxes imposed under different jurisdictions; and many other factors differing in various sections of the country. It is contended that if we were to begin *de novo* with government funds, developing water powers or building new plants with funds furnished by the government, either at low rates of interest or partly advanced by gift and the balance on loan at low rates of interest, electricity could be furnished to the domestic consumer cheaper than existing companies are now able to supply it; that such public properties would operate either wholly tax free or with a minimum of taxation, and with certain other incidental advantages over privately operated companies, thus further reducing the cost.

Raises question of fair play

Suppose all this is to be true. Is it fair? Is it just to existing investment? Is it in keeping with the declared policy of the National Recovery Act to prevent unfair competition? Is it in the spirit of American fair play?

The total taxes, Federal, State and local, now paid by the industry approximate $250,000,000 per annum out of a total gross revenue of over $1,800,000,000, or nearly 15 per cent of the gross. In the company over which I preside, the taxation cost is approximately one-third of the total of all operating expenses of every character, including generation, transmission, distribution and depreciation. In these days when all avenues of taxation are choked to the limit, where will substitute sources of taxation be found if this industry be destroyed?

The history of municipal operation of public utilities in this country, with the exception of a very small number of conspicuous and isolated cases, does not indicate that upon a fair comparative basis, they are operated as efficiently and economically as under private operation. The contrary is the case. The steady decline in the number of such plants over a recent period of years attests the truth of this statement.

Upon the merits of the case, the facts are as follows: The average bill of the domestic consumers in this country—the total number of which class of consumers run into the millions—is substantially less than $3 per month, or $36 per year. In the particular company of whose affairs I have intimate knowledge, the average is $2.80 per month, or $33.60 per year.

Relatively low cost cited

This is less than 10 cents per day; less than the cost of a package of cigarettes; less than the price of a gallon of gasoline; less than the price of a ticket to a moving picture theater; a relative trifle in the daily life of the average citizen. It is a very small portion of the budget of the average American family. Opinions seem to differ as to just what this average income is. But whatever latitude there may be in this figure, the electric bill does not exceed 2 per cent of the budget. Clothing, food and the many other necessities of life run into the high percentages of the budget, which added together equal 100 per cent.

It is stated on reliable authority that the taxation budget—federal, state and municipal—of the average American family at the present time approximates $300 per year, or nearly ten times the amount of the electrical item in the budget. It would seem to me that in the face of these facts, the so-called "power issue" has been unduly magnified. If the plan of public operation with government assistance of one kind or another is generally put into effect, whatever saving could be made, if any, in the consumers' bills would certainly be offset in whole or substantial part by an increase in taxation, which all citizens must bear, and the practical effect would be a subsidy to this undertaking, the cost of which would be borne by the nation at large.

Points to excess of power

I call especial attention to the fact that there is now existing a very substantial surplus of power available for the use of the public throughout the country, and that the full development of these water-power sources will create a huge excess of supply, running in some cases as high as 150 per cent or 200 per cent in excess of any reasonable anticipated requirement. The greatest benefit that could be hoped for by the carrying out of any such plan would be the saving of a comparatively small amount each month to the consumer in the bill which he now pays, benefiting him relatively little, but in the aggregate spelling ruin and destruction to the private companies and to their investors.

I subjoin herewith not for its legal effect but for the soundness of its economics, the following quotation from the opinion of the Supreme Court of the United States in the case of Knoxville vs. Knoxville Water Company, 212 U. S. 1, p-18:

"Our social system rests largely upon the sanctity of private property, and that State or community which seeks to invade it will soon discover the error in the disaster which follows. The slight gain to the consumer, which he would obtain from a reduction in the rates charged by public service corporations, is as nothing compared with his share in the ruin which would be brought about by denying to private property its just reward, thus unsettling values and destroying confidence."

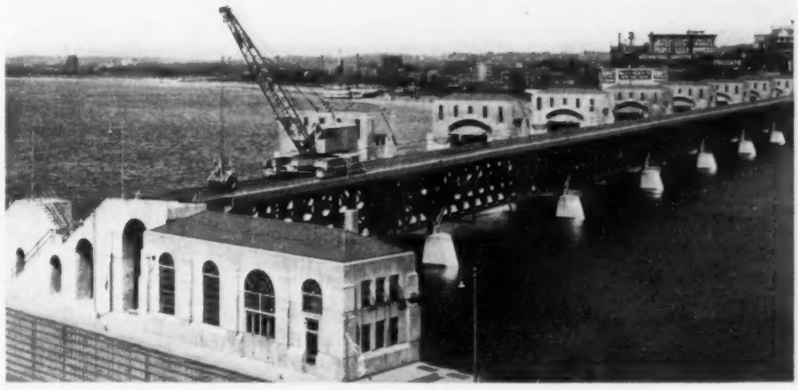
Sees danger to railroads

I feel that I should direct your attention to the baneful influence of the governmental program upon at least two other major industries, viz., the railroads and the coal industry of the country. The railroads will suffer from serious losses of freight and revenue if all the latent waterpowers of the country are to be immediately developed. The effect upon the coal companies is obvious. Both of these major industries are already in sore distress and the result of any such policy cannot but further injure them and further delay recovery. Furthermore, such a policy, if carried out, would necessarily add to unemployment, as it is well known that the amount of labor necessary to handle waterpower development is far less than that required for steam generation.

The electric industry has gone along whole-heartedly with the administration's recovery policy. It has shortened its hours of employment without diminution of wages. A large proportion of the industries are upon a five-day week of forty hours' work. If there are improper practices or abuses of any kind now being carried on, either by holding companies or by operating companies, the industry will welcome an opportunity to negotiate and arrange for their removal.

Whatever the causes, the situation that now exists is of national importance. It is bigger and broader than any particular fea-

ELECTRIC CRANE OPERATES "ROLLER" GATES



New roller gate dam on the Mississippi River at Rock Island, Ill., showing the wide-gage electric locomotive crane which operates on the service bridge of the dam. The crane was built by the Link-Belt Company.

ture of it. I am confident that if the problem is approached by representatives of all concerned, who are not extremists on the one side or the other, a solution can be found that will in a reasonable time greatly benefit the consuming public, preserve the financial and economic soundness of existing investment and at the same time directly and indirectly put many thousands of unemployed to work in many different industries. It is respectively submitted that more progress can be made along these lines than by governmental competition or strangulation. I pledge the industry to any co-operative effort along these lines, and I seek similar co-operation on the part of the government.

As to the legalities: Like yourself, sir, I am lawyer-bred, although I have not practiced for a good many years. For a considerable period of time I have been unable to shake off the conviction that the plans of the government, as typified, for example, in the Tennessee Valley Authority experiment, were *ultra vires* of its powers and an infringement upon the sovereign rights of the States concerned.

Cites opinion of Baker and Beck

In order that I might obtain the best advice upon this subject, I submitted the problem to the Hon. Newton D. Baker of Cleveland, Ohio, and the Hon. James M. Beck of Washington, D. C., both constitutional lawyers of national reputation. These gentlemen have submitted their joint opinion, declaring this policy, to the extent contemplated, to be in violation of the Constitution of the United States. Since this opinion was received there has been handed down by the Hon. W. I. Grubb, Federal district judge, at Birmingham, Ala., a decision with substantially a similar conclusion, in a case pending in the United States District Court of Alabama.

These opinions are in no wise finally controlling, but they at least create a background of serious doubt. I assume that there is no one more interested than the government in having finally settled as soon as possible the constitutionality or legality of projects upon which it is proposed to spend hundreds of millions of dollars, as to the legality of which such a doubt exists. I respectfully urge that parties interested and the government unite in taking such proceedings as will bring about a decision of the highest court in the land upon the question at the earliest moment possible.

The institute itself is not desirous of becoming a party to litigation with the government, if indeed its status would enable it to do so, but its officers and trustees realize that in their respective companies they are trustees for all these employees and investors to whom reference is made in the earlier part of this statement, whose rights are entitled to protection.

THOMAS N. MCCARTER,
President Edison Electric Institute.

Federal Power Commission Reply to McCarter Protest

The statement characterized as a memorial by Thomas N. McCarter, president of the Edison Electric Institute, which he presented this afternoon to the President, was immediately referred to the Federal Power Commission.

This memorial is a confession of the abuses of the electric power industry and an appeal against the efforts of the government to correct those abuses.

The "grave crisis" which now causes Mr. McCarter such concern had its origin when the leaders of the industry were in full control of its policies and plans. It was then that the "abuses and acts" were perpetrated which Mr. McCarter now says "cannot be defended." The investigations of the Federal Trade Commission show that they were not, as Mr. McCarter says, "the exception and not the rule." On the contrary, they permeated the industry.

Charges obstruction

The industry's representative now speaks of regulation as if it had always been welcomed by the industry. On the contrary, the record shows a policy of opposition and obstruction toward efforts at effective regulation either by the Federal Government or the State. The constitutionality of the Federal Water Power Act of 1920, which seeks to apply regulatory principles to a part of the industry, is being contested in the courts as vigorously as Mr. McCarter proposes to contest the constitutionality of the Tennessee Valley Authority Act.

A few simple facts sufficiently disclose the fallacy of Mr. McCarter's labored argument as to the reasonableness of electric rates in the United States. Official publications show that in 1932 the average domestic consumer in the United States paid $34 a year for electricity and in Canada paid $26.83.

But the consumer in Canada got 1,208 kilowatt-hours for his money and in the United States only 611 kilowatt-hours. In other words, the Canadian paid two and one-fifth cents for his electricity and the consumer in the United States five and one-half cents. These Canadian figures cover not only public plants, but also the private plants, which supply 46 per cent of the consumers.

Discounts "gloomy picture"

It is the purpose of the administration to narrow this excessive gap between what the consumer pays for electricity in this country and what Canada has proved it can be generated and sold for. This program does not involve either "destructive competition or strangulation."

Nor does the gloomy picture that Mr. McCarter paints correctly reflect the views of the progressive leaders of the industry who are most directly affected by the government's activities in the Tennessee Valley.

On the contrary, Charles A. Collier, vice-president of the Georgia Power Company, which operates in the very shadow of the Tennessee Valley Authority, told the Edison Electric Institute, at its meeting in June, 1934:

"Personally, I do not feel a bit pessimistic over the situation. I think the whole plan of the Electric Home and Farm Authority is a blessing in disguise. My suggestion is to lift yourselves out of that old attitude of mind that this utility business is a god-given right, and that the customer is there for the purpose of supporting the utility, and get on the band-wagon and you will be happier and more prosperous, and your customer happier and more prosperous as a result of such an activity."

The one concrete proposal offered by Mr. McCarter is that the government join the Edison Institute in testing the constitutionality of the Tennessee Valley Act. The policy embodied in this act was proclaimed by the President in plain language in his address at Portland, Ore., in the campaign of 1932. This policy was overwhelmingly approved by the American people in the election of that year. The act was passed by Congress after extended debates in which every conceivable question as to its constitutionality was raised. The policies of the administration were again endorsed by the American people in 1934.

We are therefore confronted with this situation: On the one side we have the opinion of the two eminent lawyers retained by Mr. McCarter. On the other, we have the opinion of the majority of the American people, the decision of learned constitutional lawyers in both houses of Congress, the views of the President and the many able counsel in the executive departments.

Calls proposal unparalleled

And yet Mr. McCarter now suggests that the government cast doubt upon the validity of its own legislation by joining with him in litigation to test the government's own powers. In all the history of the American Government no parallel for such a proposal can be found.

The Edison Electric Institute has, of course, a legal right to promote litigation to test the act creating the Tennessee Valley Authority or any other statute, but it will make no substantial progress toward placing the electric industry on a sound and permanent basis until it cleans its own house, reduces excessive rates to consumers, and eliminates the malpractices and abuses which are responsible for its present condition.

The call is not for the government to halt but for the industry to catch step and move forward along progressive lines.

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Business Leaders Adopt Recovery Program

The joint business conference for economic recovery meeting this week at White Sulphur Springs, W. Va., with the purpose of effecting conciliation of business with the federal administration, drew up an eleven-point program for recovery which included extension of NIRA for a year with slight modifications.

It followed the lead of the National Association of Manufacturers in asking that acceptance of codification be made voluntary for industry. To bring this about the conference asked that a board of five, which it wants the government to create to administer the codes, receive power to abrogate codes now in force, after a hearing.

The conference also provided for its own continuance and the creation of some still undefined permanent board in Washington to unify the voice of all business in governmental affairs and make the influence of business men more strongly felt in legislation than it has been heretofore.

On the thirty-hour week there was unanimous opposition and, in the committee on social security, there was complete agreement on the British type of dole as preferable under the present stage of recovery to the made-work type of relief practiced by the Administration.

Resources Board Acknowledges Limitations to Hydro Development

Electricity considered essential to resumed standard of living — Hydro viewed as a back-up source — Utility investments not to be ignored in comprehensive plan submitted to President Roosevelt

Started under the predecessor Roosevelt, the movement for conservation of our natural resources has attained a remarkably comprehensive status in the plan outlined to President Roosevelt by the National Resources Board, on which five of his cabinet officers are members. Land, water and minerals will under this plan be treated as national assets to be developed and conserved in the interests of the whole nation's future economic security and social enhancement. Reclamation, subsistence homesteads, grazing, forestation, erosion, wild life, recreation areas, stream pollution, watersheds and public works emergency programs are all brought into correlation.

One of the most specifically framed sections is that on water resources, but that on hydro-electric power is somewhat less so because there is a special board (Power Policy Committee, also headed by Secretary Ickes) which will report soon to the President. Nevertheless, the presence of Messrs. Ickes and M. L. Cooke on both boards makes the present pronouncements on hydro developments properly significant. To quote some of the most pertinent observations:

"One of the objectives which national planning should strive to attain is to provide all sections of the country with all the electric power they may require at the lowest possible cost. From the long-run viewpoint, the desirability of conserving natural resources makes the full utilization of all available water power seem highly desirable. . . From the short-run commercial viewpoint . . . it is commonly less costly to provide electricity by combustion methods than by harnessing water power and building transmission lines. . .

"The great technical advantage of water-power plants is that they can be turned on for a few hours' work and then turned off again without much loss. Their place in the present technical scheme is mainly that of a supplementary source, used to carry peak loads for brief periods, while all of the load part of the time and the bulk of the load the rest of the time is carried by the economical fuel burners. . . The remaining sites are mostly expensive to develop, distant from markets, unreliable in flow, or undesirable in some other respects from the strictly commercial viewpoint.

"Experience indicates that marked economies are effected when interconnecting transmission lines are built to tie all the generating units and all the consumers of a wide area into one circuit. . . The total investment required for a given standard of service is thus greatly reduced by interconnection, and with the investment the necessary charge to consumers is also reduced.

"The government has an interest in extending the use of electricity as an increasingly significant item in the American standard of living. Hence it has an interest in the reduction of rates to stimulate consumption. It has a special interest in the development of hydro-electric plants as a means of conserving the country's resources in coal, gas and oil. In some cases its plans for flood control or other uses of water would enable it to provide hydro-electric power as a byproduct at slight direct cost.

Invested capital a factor

"The government will not fail to consider as a factor in the total situation the large sums of capital actually invested by the power companies. The critical questions for the government are how far the elasticity of the demand for electricity and the economies produced by interconnecting transmission lines may make it possible to reconcile these seemingly conflicting interests, and, to the extent that reconciliation is not possible, which interests should be given preference."

Considering that the National Resources Board and the Power Policy Committee both have members who have been considered none too friendly to privately owned utilities, these pronouncements are a startling confirmation of what the electrical industry has been contending right along. Nevertheless, there is enough indefiniteness to allow all sorts of inferences as to what the other committee will report later.

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Commission Says Utilities Fought Public Plants

Activities of the electric and gas utilities in opposition to public ownership were described in another installment of the Federal Trade Commission's report made to the Senate last week. "The privately owned utility industry," the report stated, "has actively and continuously opposed public and municipal ownership and operation, characterizing it as unsound and un-American doctrine. For a long time, the privately owned utilities directed their attacks especially against such projects as Muscle Shoals and Boulder Dam, and the more outstanding publicly owned and operated systems, such as those operating in Ontario, Canada, and at Seattle, Cleveland, Los Angeles and Springfield, Ill."

COMING MEETINGS

American Engineering Council—Annual meeting, Washington, D. C., January 10-12. Frederick M. Feiker, executive secretary, 744 Jackson Place, N. W., Washington, D. C.

American Institute of Electrical Engineers—Winter convention, New York, N. Y., January 22-25. H. H. Henline, National Secretary, 29 West 39th Street, New York, N. Y.

National Electrical Manufacturers Association — Midwinter conference, Waldorf-Astoria Hotel, New York City, February 6-8. W. J. Donald, 155 East 44th St., New York.

EVENTS IN WASHINGTON

Before the end of January the Federal Power Commission expects to issue its report covering the costs of electricity to the residential consumer on January 1, 1935, as compared with rates in effect July 1, 1934.

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Within thirty days the staff of the Federal Power Commission will have concluded its study of headwater benefits accruing to the San Joaquin Light & Power Corporation from the headwater storage at the Southern California Edison Company's Big Creek project.

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In the opinion of some experts the Buzzards' Roost project of Greenwood County on the Saluda River will be a better yardstick than the T.V.A. project, in that it is not complicated by a variety of operations, as is the government's development in the Tennessee Valley.

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Because of the fundamental questions involved, officials in Washington are showing great interest in the forthcoming proceedings in the U. S. Court for the Southern District of West Virginia involving the Hawk's Nest project on New River.

PAUL WOOTON,
Washington Correspondent.

T.V.A. Sanctions City-Owned Plants

Advises three cities involved in Alabama deal to proceed with own plans — Hearing date set on T.V.A. legality

When T.V.A. and Alabama Power entered into a contract for transfer of properties and facilities in northern Alabama it did not involve the distribution system of several towns served. These were subject to direct sales negotiation between the municipalities and the Alabama Power Company. All seemed favorable to the completion of the deal and the Alabama Public Service Commission approved the transfer. But preferred-stock holders went to court against the sale and it is now held up by this litigation. This week D. E. Lilienthal advises three towns to go ahead and put in their own distribution systems—Florence, Sheffield and Tuscumbia in the near vicinity of Muscle Shoals. Incidentally, the bank, acting as trustee for bonds issued against these distribution properties, is having a valuation made by Ford, Bacon & Davis to measure the jeopardy in which the bonds are placed if the municipalities build competitive distribution systems.

Forney Johnson, representing coal and ice companies, has filed notice of appeal of the Commission's approval of the sale of the $2,200,000 worth of Alabama Power property to T.V.A. and the hearing on this and the general constitutionality of the T.V.A. program will begin before Federal Judge Grubb on January 28. Meanwhile the commission had all fourteen Alabama electric utilities in for a conference on December 11 and intimated that they would have to meet the "practical matter" of the T.V.A. threat by matching the yardstick rates as nearly as they can.

Knoxville is going ahead with its plans for a city owned distribution system, hoping to get approval of P.W.A. engineers so the $2,600,000 loan-grant can be secured, bids filed and work started by the first of the year. The North Little Rock city council instructed Mayor Moore and two aldermen to visit T.V.A. and look into obtaining power from there. On December 18 some eighteen northern Mississippi towns were represented at a meeting in Cleveland, Miss.

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A.I.E.E. Nominations

The national nominating committee of the American Institute of Electrical Engineers has nominated E. B. Meyer, vice-president United Engineers & Constructors, Inc., for the presidency. The following were nominated as vice-presidents: W. H. Harrison, Bell Telephone Company of Pennsylvania; Mark Eldredge, Memphis Power & Light Company; R. H. Fair, Northwestern Bell Telephone Company; N. B. Hinson, Southern California Edison Company, and C. V. Christie, McGill University.

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Edison Medal Awarded to Willis R. Whitney

The Edison Medal for 1934 has been awarded by the American Institute of Electrical Engineers to Dr. Willis R. Whitney, "for his contributions to electrical science, his pioneer inventions and his inspiring leadership in research." The medal will be presented to Dr. Whitney during the winter convention of the institute to be held in the Engineering Societies Building in New York January 22-25, 1935.

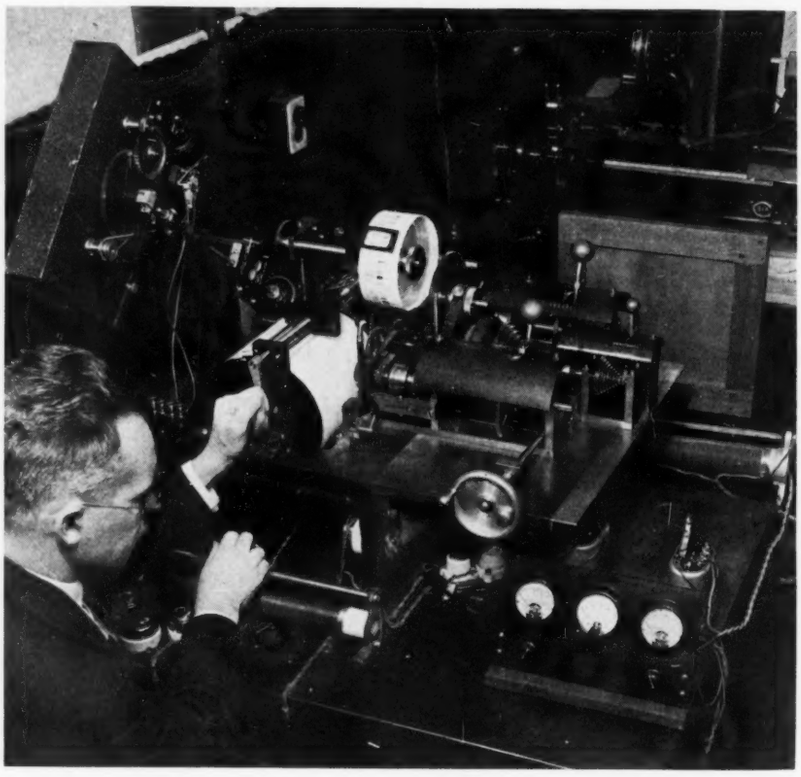
Dr. Whitney assumed the directorship of the research laboratory of the General Electric Company at Schenectady, N. Y., in 1900, became vice-president and director of research in 1928 and vice-president in general charge of research in 1932.

West Virginia Intervenes in New River Case

Challenging the constitutionality of the federal water-power act in so far as it attempts to give the Federal Power Commission jurisdiction over non-navigable streams, the State of West Virginia on December 14 intervened in the government's suit to require federal licensing of the Hawk's Nest project on New River being undertaken by the Electro-Metallurgical Company, the New Kanawha Power Company and the Union Carbide & Carbon Company of New York.

Attorney-General Homer A. Holt in the state's petition says that if the court should require a federal license, it "would establish a precedent of federal ownership and control of hydro-electric rights, not only in the New River, but in many other streams in the State of West Virginia which are non-navigable and destroy the rights of the state to license, dispose of or use hydro-electric or water-power rights in such streams. . ."

ELECTRICAL METHODS SPEED UP SPECTROSCOPY



Increased accuracy and speed in measuring spectra have recently been achieved at the Massachusetts Institute of Technology through the development of new equipment by Prof. G. R. Harrison, director of the spectroscopy laboratory. Formerly spectrum measurements to 1/25,000 in. were made by a comparator, with visual observation of separation distances, a task often requiring several days. The new equipment, shown with Professor Harrison at the working table, now makes measurements twenty times faster than the comparator while doubling the accuracy of the results. In its operation a light beam takes the place of the eye in recording the measurements.

Unit House Construction Program Built Around Electric Service

Pre-fabricated house, engineered with central service features and complete built-in electrical equipment, opens possibilities for load development — Power company executives see big opportunity

Power company executives have been inspecting a new pre-fabricated small house that has been on private view in the Grand Central Palace Building in New York for the past few weeks. Planning and construction seem to offer interesting possibilities for the sale of complete electrical equipment and for reduction in the cost of wiring in a low-priced house presenting attractive innovations.

This new house has been developed by Houses, Inc., of which Foster Gunnison is president. Much secrecy surrounds the sponsorship of this new development, but the electrical industry is closely involved. The house is built around a central service unit containing a modern electric kitchen and bath and a service compartment in which the plumbing, house heating, water heating, air conditioning and wiring arrangements, a built-in radio, electric clock and other features are concentrated. The rooms are arranged around this service unit so that wiring connections are short. A single unit of piping connects all plumbing. It is an engineered house, providing an appealing variety of new conveniences and comforts, with economies impossible in ordinary construction.

The house needs no cellar. It can be erected with one or two stories and additional rooms may be built on at any time at a comparatively small cost, being serviced from the same central unit. The frame of the house is of steel and the exterior walls are two sheets of an asbestos compound with an insulating material between. Side wall sections are bound together with aluminum strips. Inner walls, floors and ceilings are made of a patented mineral compound.

The minimum arrangement of living room, two bedrooms, kitchen and bath, complete with electric range, refrigeration and air conditioning, will probably sell for $3,900 erected on the buyer's lot. The owner pays $38 a month for fifteen years and receives fire insurance and a life insurance policy, so that if he dies before the payment is complete the widow owns the house without debt. The entire house and equipment is delivered on the lot in a truck and erected in fourteen days, the erectors meanwhile living in the truck.

Westchester colony being erected

The present units will provide for twelve floor plan arrangements. A colony of these houses is now being erected in Westchester County, to be lived in this winter as a practical trial. Photographs and floor plans will be available as soon as the Westchester County units are erected.

Because of the low cost, economy of operation and the natural setting for complete electrical equipment, which the house provides, utility company men see in it a powerful agency for domestic load building.

A large number have already been ordered for delivery when ready, to be erected by power companies in their residence communities, as a demonstration house for home equipment. It is believed that this inexpensive house will have a further advantage of encouraging home builders to buy higher priced land nearer town and add to the density of the lines. The house, of course, is designed to meet the present need for low-cost housing in the hope that it may provide that new industrial development that will bring the lift to business recovery for which the country has been waiting.

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Power Authority Assailed for Refusing Rate Data

In a letter addressed to Frank P. Walsh, chairman of the New York Power Authority, Milo R. Maltbie, chairman of the New York Public Service Commission, accused the Power Authority of failure to co-operate to obtain proper regulation of utility rates in the state. Mr. Maltbie's letter followed an announcement by the Power Authority of its unwillingness to submit to the commission, in the form of sworn testimony, the data contained in a recent report, that electric rates throughout the state should be substantially reduced.

"The commission regrets exceedingly," Mr. Maltbie wrote, "that you have seen fit to decline our request, particularly as the data desired were compiled at state expense and with the assistance, to some extent, of this commission."

Mr. Maltbie's letter continued: "The distribution of electric energy generated upon the St. Lawrence River under your authority at best cannot become a reality for several years. It has seemed to us, therefore, that the electric consumers in the state of New York ought to have immediately the benefit of the data, the compilation of which has consumed several years and cost a considerable sum, without waiting for a possible reduction in certain rates due to the construction and operation of a gigantic project upon the St. Lawrence River. It has seemed to us that a co-ordinate state body ought to be willing and even anxious to assist this commission in obtaining lower rates, which you assert are fully justified by the facts at your disposal. . . We do not understand your reluctance to follow this course. . ."

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Roosevelt Intervenes in New York Rate Case

Following the rejection by New York City officials of all bids to supply electric energy to the city on the grounds that the rates were exorbitant, President Roosevelt immediately extended invitations to Mayor LaGuardia and Maurice P. Davidson, New York City Commissioner of Water Supply, Gas and Electricity, to call at the White House. The President assured the Mayor of federal assistance in the construction of a municipal electric power plant to supply the needs of the city.

When he rejected the bids of the New York utilities, Commissioner Davidson explained that the bids showed that the companies were not disposed to "remedy their excessive charges," hinting strongly that the city would undertake to distribute and, if need be, generate its own electric energy. The city's lighting bill, if the bids submitted were accepted, would be $10,541,000, some $200,000 more than the 1933 bill and only slightly less than the bill for 1934.

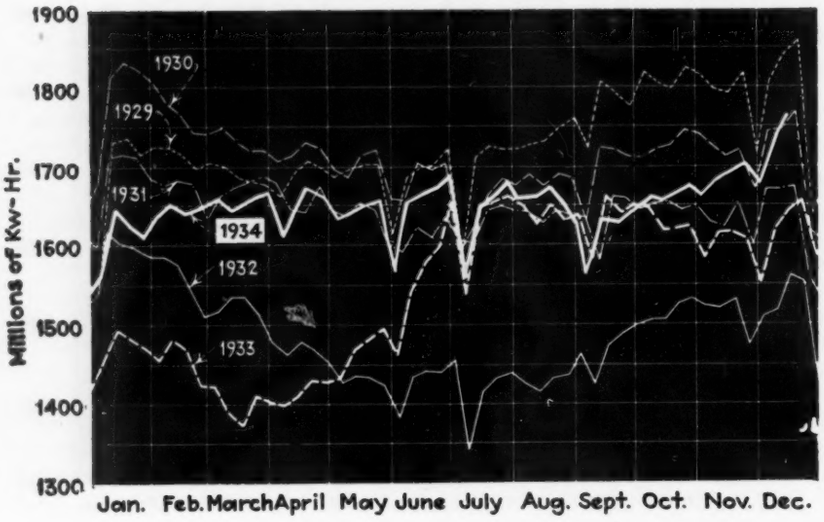
State inquiry opens

At the first hearing of the New York State legislative committee investigating public utilities, held in New York City, the political activities of utility leaders, the juggling of stock values, bookkeeping methods and set-ups of holding companies were developed.

On the financial side, the power group was accused of having caused an $82,000,000 write-up in assets of the Niagara Hudson Power Corporation at the time of its formation. Two of the chief backers of the corporation were F. L. Carlisle & Company and J. P. Morgan & Company.

The evidence concerning the interest of the utilities with legislative and other political matters consisted of letters from the files of the Niagara Hudson Power Corporation. H. Edmund Machold, former Republican state chairman and now an official of that corporation, was involved in a great deal of the correspondence. It was announced, however, that the investigation so far had produced no letters indicating wrongdoing by any one.

Output Rising at Record Speed



Breaking every record for the second week in December excepting 1929, the energy output of central electric light and power stations during the week ended December 15 rose to 1,767,418,000 kw.-hr., according to the Edison Electric Institute. The rise which has been in progress during the past several months has developed into an upward surge never before experienced at this season, so far as records are available.

The gain over the preceding week was 24,000,000 kw.-hr. Production was 134,000,000 kw.-hr., or 8.2 per cent above that of mid-September, 7.5 per cent over the same week last year, 1.1 per cent over 1930 and far ahead of all intervening years. Only 1929 remains to be beaten, and the difference compared with that year is now only 4 per cent. Every section of the country is pulling more energy than a year ago, the increase ranging from 4.1 per cent in New England to 11.1 in the Mountain States.

Weekly Output, Millions of Kw.-Hr.

1934	1933	1932
Dec. 15...1,767	Dec. 16...1,644	Dec. 17...1,563
Dec. 8...1,743	Dec. 9...1,619	Dec. 10...1,519
Dec. 1...1,684	Dec. 2...1,554	Dec. 3...1,510
Nov. 24...1,705	Nov. 25...1,608	Nov. 26...1,475
Nov. 17...1,691	Nov. 18...1,617	Nov. 19...1,532
Nov. 10...1,676	Nov. 11...1,617	Nov. 12...1,521

Per Cent Change from Previous Year

Region	Week ended Dec. 15	Dec. 8	Dec. 1
New England	+ 4.1	+ 3.5	+ 7.0
Middle Atlantic	+ 6.2	+ 5.2	+ 7.3
Central Industrial	+ 8.3	+ 7.0	+ 8.2
West Central	+ 5.1	+ 6.2	+ 9.7
Southern States	+10.0	+13.1	+15.6
Rocky Mountain	+11.1	+13.2	+12.8
Pacific Coast	+ 5.4	+ 3.2	+ 1.5
United States	+ 7.5	+ 7.7	+ 8.4

Architects to Compete on Electrified Home Designs

To stimulate the electrical equipment of the new homes that America is about to build as recovery progresses, the General Electric Company is sponsoring a national competition among architects. The competition will begin on January 1. Its objective is to promote the design of small homes that will provide the utmost in modern convenience and economy.

A total of 54 prizes, aggregating $21,000, will be offered to architects and designers. These house plans will develop the possibilities for the utilization of electric service for labor saving and comfort in small dwellings that will take full advantage of modern ideas and materials. It will be possible for one architect to win awards amounting to $5,000. Demonstration homes will later be constructed in various parts of the country from the winning plans. The Federal Housing Administration is much interested in this contest, which has just been announced by Gerard Swope, president of the General Electric Company.

"This competition will enable the public to get a new vision of what an inexpensive home can be like in this new era of our national development," Mr. Swope said. "Science has made great strides in home electrification even through the depression years. There is no longer any need for the homemaker to tire herself out with household labor. Most of it can be done more simply, efficiently and less expensively by electrical servants. . . . All of the new advances in the art of living should be made available to everybody, and we are confident the architects of the country will be able to show in their designs just how this is to be done in the small homes."

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Jackson to Vote on Plant

To finance the construction of a municipal electric light and power distribution system the City Commission of Jackson, Miss., has ordered an election for January 22 to vote on a proposal that the city issue $1,500,000 in bonds. The election is called pending an adjustment of the rate controversy with the Mississippi Power & Light Company. The city would purchase power from the Tennessee Valley Authority if the municipal project is approved.

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New Construction Awards Dropped in November

Construction award figures for November showed a decline both as contrasted with data for October and with the figures for November of last year, according to F. W. Dodge Corporation. The November construction contract total, all classes, amounting to $111,740,800 in the 37 Eastern states, was more than 30 per cent behind the volume of $162,340,600 reported for November, 1933, and compares with $135,224,800 for October of this year. For the elapsed eleven months of 1934 contracts for construction, all types, totaled $1,450,426,900 in the 37 states as compared with $1,048,498,900 for the corresponding months of 1933.

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Standard Gas Omits Prior Preference Dividends

As a cash conservation measure, in anticipation of the program for the refunding of $25,000,000 6 per cent notes of Standard Gas & Electric Company due October 1, 1935, the board of directors of the company has voted to omit the quarterly dividends on the $7 and $6 prior preference stocks on which dividends have been paid at the annual rate of $2.10 and $1.80 per share respectively since September 30, 1933.

John J. O'Brien, president of the company, pointed out that earnings are substantially in excess of the annual rate of dividend payments during the past year and that with completion of the refunding program dividend payments on prior preference stocks could be resumed at least on a partial basis.

In line with the action taken by the Standard Gas directors the board of Standard Power & Light Corporation voted to omit the quarterly dividend on the preferred stock of the corporation, on which dividends had been paid at the annual rate of $2.10 per share since September 30, 1933.

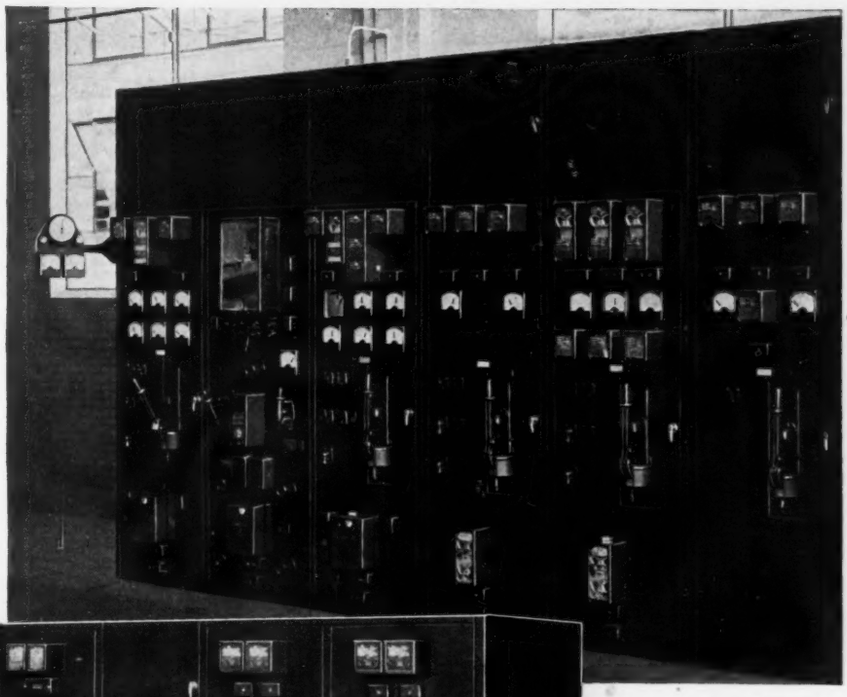
New York Metal Prices

	Nov. 21, 1934 Cents per Pound	Dec. 19, 1934 Cents per Pound
Copper, electrolytic	9.00*	9.00*
Lead, Am. S. & R. Price	3.50	3.70
Antimony	13.12	13.75
Nickel ingot	35.00	35.00
Zinc, spot	4.025	4.10
Tin Straits	51.25	50.95
Aluminum, 99 per cent	23.30	23.30

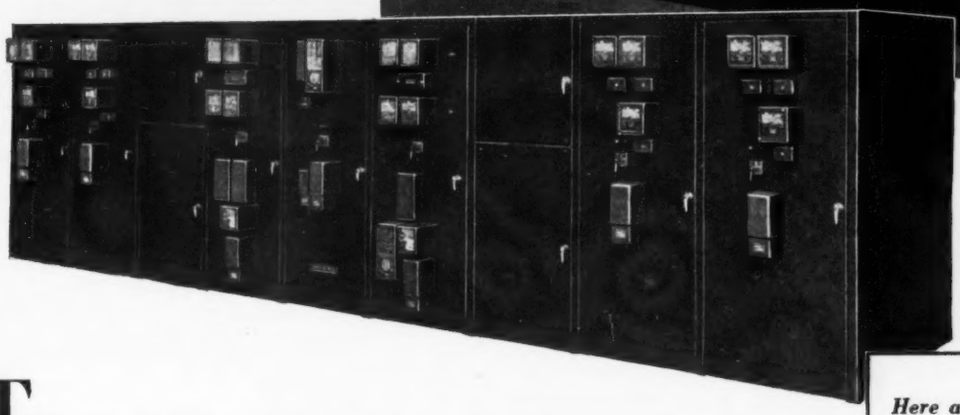
*Blue Eagle.

Here's an Idea

that will cut your over-all switching costs



(Right) G-E cubicle switchgear installed in an industrial plant



(Left) G-E metal-clad switchgear for installation in an office building

THE idea is—buy your switchgear completely assembled, ready to use. When you order shipped-assembled switchgear, you reduce your installation and maintenance costs; you conserve valuable floor space through the greater compactness of these units; you get better protection; and you may reduce future expense, for this equipment can be moved as a unit.

Shipped-assembled switchgear is modern switchgear. It saves you money, gives you a better-engineered product, and puts responsibility for satisfactory operation on a single manufacturer.

G-E switchgear specialists will be glad to send you additional information, or to discuss this equipment with you and make recommendations for your plant or station. Address the nearest G-E office, or General Electric, Dept. 6-201, Schenectady, N. Y.

Here are types of switchgear that are shipped assembled:

1. Metal-clad switchgear and cubicles for the control and protection of machine and feeder circuits

2. Metal-enclosed units for light-duty distribution circuits

3. Enclosed air-circuit-breaker boards for industrial service and low-voltage distribution

820-9

GENERAL ELECTRIC

Martin Insull Trial Opens; Middle West Hearing Held

Counsel for Martin Insull challenged the prosecution to show that any funds of Middle West Utilities Company had been used to bolster a stock brokerage account in which Mr. Insull had an interest at the embezzlement trial which opened recently before Judge Cornelius J. Harrington. Oliver E. McCormick, vice-president and treasurer of Middle West, disclosed that a syndicate of Middle West and subsidiary companies was formed to support the brokerage account by participating in it. The defense raised the point that Mr. Insull was charged with embezzling money of the Middle West Company, whereas the evidence showed that the companies which went to the rescue of the brokerage account and purchased the securities involved outright, gave their checks for their interests in the syndicate.

Conflict between Middle West Utilities Company creditor and stockholder interest over the company's proposed reorganization continues. At a hearing held last week Judge Wilkerson indicated that he was not so much concerned with the company's solvency as he was in learning if the plan was fair and equitable and not discriminatory against any interest in the company. The court continued hearing until January 28.

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American Gas Cash Dividend

American Gas & Electric Company has discontinued payment of dividends in stock on the common stock, declaring an extra dividend of 20 cents in cash and the regular quarterly dividend of 25 cents, both payable January 2 to stockholders of record December 8. In addition to the regular quarterly dividend of 25 cents a share on the common, the company had been paying 2 per cent semi-annually in stock on the common.

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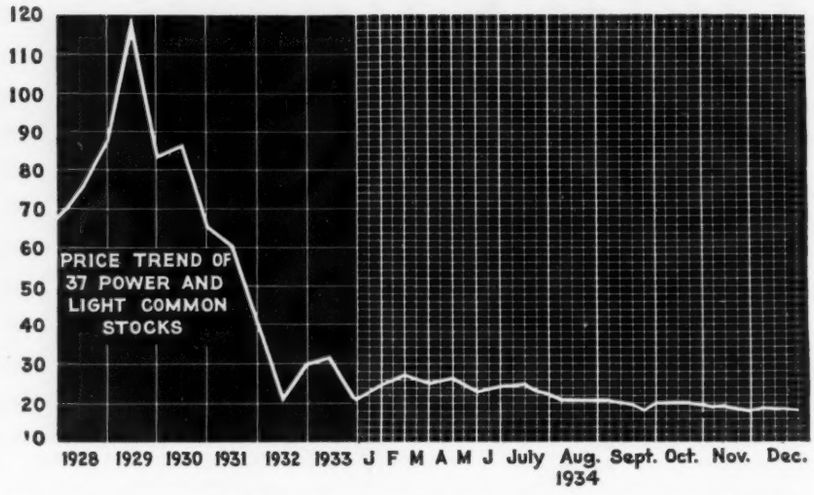
$10,000,000 Canadian Issue

Refunding 3½ per cent bonds of the Hydro-Electric Power Commission of Ontario, to the amount of $10,000,000, guaranteed as to payment of both principal and interest, have been awarded to a syndicate composed of the Dominion Securities Corporation; Wood, Gundy & Company, Canadian Bank of Commerce, Royal Bank of Canada and A. E. Ames & Company.

Utility Stocks Slightly Lower



Stock prices in the public utility group lost some ground during the past week. "Electrical World" index, 18.8; last week, 19.0.

New York Utilities Seek to Amend Rate Schedules

Because of the heavy increases in their operating taxes, culminating in those recently enacted by the city of New York, the electric, gas and steam companies of the Consolidated Gas Company System in New York City filed last week with the Public Service Commission amendments to their rate schedules containing a tax-adjustment charge to be applied on a percentage basis to all bills to customers. The companies also filed applications with the commission asking that the tax-adjustment charge be placed in effect January 1, 1935, the date when the city's 3 per cent tax on gross receipts becomes effective.

The new tax-adjustment charge is shown in the applications to have been computed so as to yield an amount equal to the increase in the operating taxes of the companies for the year 1935 over those for the year 1933, the increase amounting to approximately $14,000,000. The commission denied the petition and set the date for a public hearing on January 9.

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Superpower Omits Dividend

American Superpower Corporation has notified holders of its first-preferred stock that the market value of its assets on November 30 had fallen below the total capital, making it necessary to suspend dividends under the provisions of the corporation laws of Delaware. The directors have, therefore, omitted the quarterly dividend of $1.50 a share on this stock due at this time. At the same time the corporation announced that it is prepared to purchase for retirement first-preferred stock at $53.50 per share from such holders as may wish to sell.

Current Earnings Reports

Operating Companies

	1934	1933
Alabama Power (Year to Oct. 31)		
Gross earnings	$15,390,301	$15,517,240
Net balance	514,479	918,831
Detroit Edison (Year ended Oct. 31)		
Gross earnings	44,430,108	41,649,150
Net balance	6,936,870	6,584,920
Duquesne Light (Year ended Oct. 31)		
Gross earnings	25,299,036	23,924,641
Net balance*	9,922,531	10,897,902
Kansas City Pwr. & Lt. (Year ended Oct. 31)		
Gross earnings	14,663,418	14,273,491
Net balance	3,313,829	3,344,565
New Orleans Public Serv. (Year ended Oct. 31)		
Gross earnings	15,032,207	14,871,931
Net balance	213,640†	186,100
Pennsylvania Pwr. & Lt. (Year ended Oct. 31)		
Gross earnings	33,931,076	32,866,018
Net balance	5,365,111	5,653,940
Puget Sound Pwr. & Lt. (Year ended Sept. 30)		
Gross earnings	13,089,229	12,632,203
Net balance	1,527,536†	762,819†
Virginia Elec. & Pwr. (Year ended Sept. 30)		
Gross earnings	15,011,340	14,730,665
Net balance	1,464,324	2,238,004

Holding Companies

	1934	1933
American Power & Lt. & subsidiaries (Year ended Oct. 31)		
Gross earnings	$75,250,561	$73,111,313
Net balance	3,337,065	5,024,664
Commonwealth & Southern & subsidiaries (Year ended Oct. 31)		
Gross earnings	114,069,321	108,957,151
Net balance	843,958†	277,817†
Electric Power & Light & subs. (Year ended Oct. 31)		
Gross earnings	73,207,306	68,615,788
Net balance	344,831†	776,900†
National Pwr. & Lt. & subs. (Year ended Oct. 31)		
Gross earnings	71,397,949	68,725,961
Net balance	6,767,593	7,144,945
North American Co. & subs. (Year ended Sept. 30)		
Gross earnings	106,898,390	106,976,408
Net balance	8,709,562	11,110,784
Public Service of N. J. & subs. (Year ended Oct. 31)		
Gross earnings	120,133,785	117,448,384
Net balance*	24,941,534	26,811,271

*Available for all dividends. †Deficit.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net balance—Balance available from income for common stock dividends.

Step Regulator Holds Plant Voltage

By E. K. ALBERT* . . J. S. PARSONS†

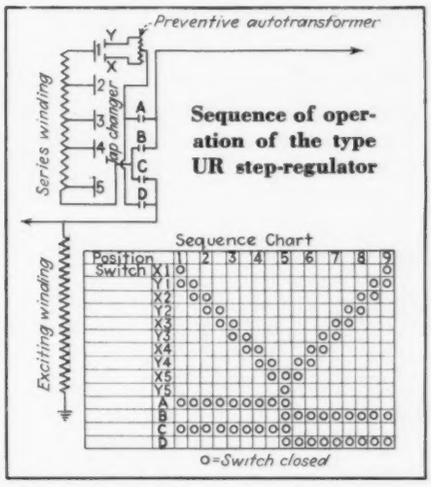
When the widely varying, low power factor load of a sizable packing company was connected to the Northwestern Public Service Company's system it seriously affected the voltage on the 33-kv. bus at the Huron substation. Although induction regulators smoothed out the voltage on feeders supplying the city, the voltage at the packing plant varied from 220 to 250 volts, with only 5 volts due to the drop in the 11,900-volt supply line and step-down transformer at the plant. Because of lighting the plant's maximum permissible voltage is 250 volts and because of small wire in certain power circuits and the load's low power factor the lower limit is 230 volts.

Huron substation has approximately 1,500 kw. of oil engine standby capacity, and since the packing plant is an important customer, enough of this generating capacity was put in operation to raise the voltage at this point on the system. It was soon found that the cost of remedying the voltage condition by this method would be about $1,800 per year, so it was decided to install regulating equipment on the packing plant line.

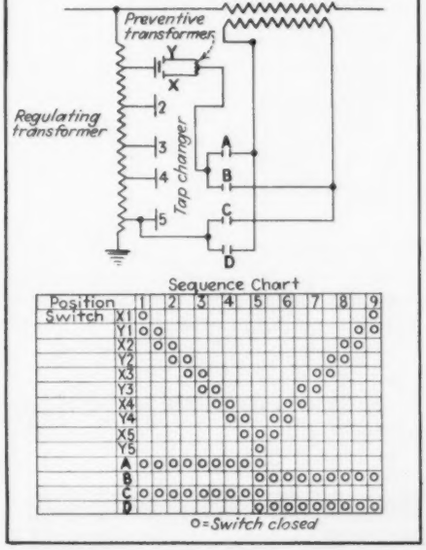
The packing plant is located about 2.5 miles from the substation. Five small towns, from 8 to 25 miles from the station, place a total load of about 150 kw. on the supply line. The load at the packing plant is about 50 kw. from 7 p.m. to 7 a.m. and varies from 100 kw. to 450 kw. during the rest of the day, with a power factor ranging from 55 to 75 per cent. The load on the circuit was well enough balanced so that a three-phase regulator would be satisfactory, and a careful study of all factors indicated that a step-voltage regulator having four 2.5 per cent steps above and below normal or a 10 per cent buck or boost induction regulator with suitable shunt and series transformers could be used.

A complete comparison of the installed cost of the three-phase step-regulator with a three-phase, 2,400-volt induction regulator and the necessary auxiliary transformers showed the cost of the step-voltage regulator installation to be only about 60 per cent of the induction regulator installation. The step-regulator installation with by-pass and disconnecting switches cost about $3,200, including all labor and construction overheads.

Since being placed in service this step regulator has maintained a normal voltage at the packing plant of 244, with a maximum variation of slightly less than 238 to 250 volts, thus enabling satisfactory service to be rendered. Under present conditions the regulator operates about six times in 24 hours, or at the rate of approximately 2,200 times per year. In view of the fact that tests indicate the life of the tap-changer contacts should be at least 200,000 to 250,000 operations, the expense of maintaining this equipment should be very small.



The maximum boost position is secured with transfer switches *X1* and *Y1* and reversing switches *A* and *C* closed. Position 9 on the chart is the maximum buck position.



Connections for step-voltage regulator when current in line exceeds 100-amp. current rating of tap changer

The series transformer reduces the line current to the current rating of the switches.

•

Renovizing Rusted Line Hardware

Depreciation of the zinc coating on line hardware will eventually require a decision on whether to replace the hardware or recoat it. One company which has had considerable experience with recoating such material sounds the following warning:

"Various kinds of line hardware, such as insulator pins, through-bolts, double-arm plates, saddle braces, forged strain clamps, suspension clamps, insulator caps and secondary racks, depreciate with exposure and must be replaced or reprotected against weathering. We employ the latter course to a great extent, but false economy will result unless the total expense of recoating, including transportation, is compared with the cost of new equipment. Furthermore, when the protective covering or relatively thin sections depreciate, preparation for recoating may reduce the parent metal so much that the value or safety of the rehabilitated piece is greatly reduced. This is true of small pins, threaded material, etc. The

*Superintendent transmission and distribution, Northwestern Public Service Company, Huron, S. D.

†Central Station Department, Westinghouse Electric & Manufacturing Company, East Pittsburgh.

proximity of an experienced galvanizing or sherardizing plant is also important as transportation as well as quality of work are important elements in the cost comparison.

"We pay 5 to 6 cents per lb. of equipment treated to have a local organization do the rehabilitation work. Consequently it is found that some heavy, though relatively inexpensive, parts might better be replaced.

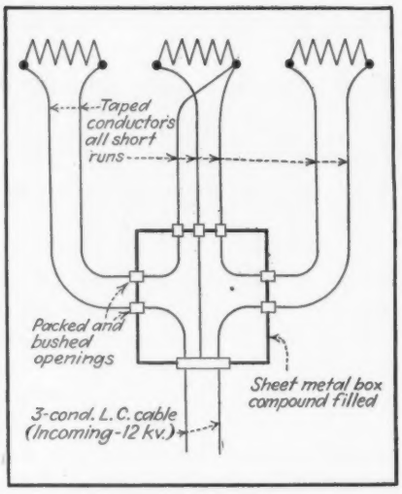
"When suspension insulator caps or suspension clamps show signs of deterioration they are sandblasted and sprayed with molten zinc. The porcelain is protected against the sandblast. Rehabilitation of insulator caps costs about one-fifth the price of new units."

•

Cable Divider Box Simplifies Star

Usually the star primary connections to a transformer bank are made by fanning out the cable conductors to a bus from which leads are tapped off to the transformer terminals. The bus must have four conductors, since an additional one is needed for the neutral primary tie. Such construction requires fifteen conductor joints, six of which are at the transformer terminals and nine on the bus. But the primary bus structure is entirely eliminated and the fifteen conductor joints reduced to seven by the simple arrangement which is installed in the main substation of a large midwestern manufacturing plant.

Here are three 333-kva. transformers, 12,000/4,000 volts. The 12-kv. supply cable, instead of terminating in the conventional pothead, runs to a steel box mounted on a pipe frame in front of the middle transformer. The cable conductors are not cut off in the box. One runs straight through and, emerging through a properly packed and insulated opening on the opposite end, connects to the phase terminal of the center transformer. The two other cable conductors run through the box and out at the two sides to the phase terminals of the two other transformers, as is shown in the drawing.


Taped conductors all short runs
Packed and bushed openings
Sheet metal box compound filled
3-cond. L.C. cable (Incoming-12 kv.)

Primary bus eliminated

The neutral leads from these transformers run into the box and out to the neutral terminal of the middle unit. In the whole arrangement there is only one crossing of conductors, and that is not in the box. Neither does the box, which is filled with compound, contain any joints.

•

Slide Rule Checks Time

By A. J. LOBECK
Superintendent of Distribution,
New York Edison Company

In order to obtain better administrative control of consumer repair calls it is highly desirable that the various steps of the operation be studied with respect to time element. The component time parts for a complete operation are:

1. Time interval between receiving call from consumer and dispatching same to a serviceman in the field.
2. Traveling time of serviceman from time of receiving call to arrival on consumer's premises.
3. Time interval on consumer's premises necessary for locating and repairing cause of service interruption (which usually consists of replacing a fuse) and/or advising consumer of steps to be taken where consumer's apparatus or wiring is involved.
4. Time interval of waiting for next repair call.

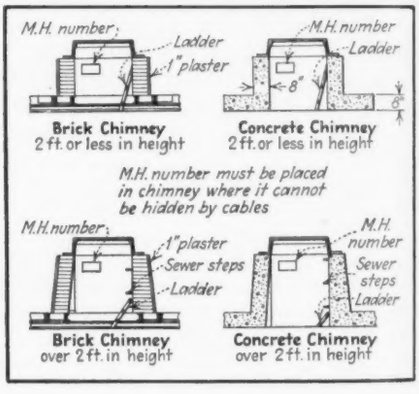
To increase accuracy and reduce the time and expense of analyzing the report sheets the device shown in the illustration was developed by the writer and G. H. Peters. It consists of a slide rule with two scales to make the necessary subtractions.

The operation consists simply of setting the zero line on the "B" scale underneath the time (which is arbitrarily assigned) of starting on the "A" scale and then reading to the right on the "A" scale to the time of completion of the operation and directly underneath this time on the "B" scale is read the elapsed time for the operation in question.

This device also lends itself readily to the calculation of time outages on street lamps.

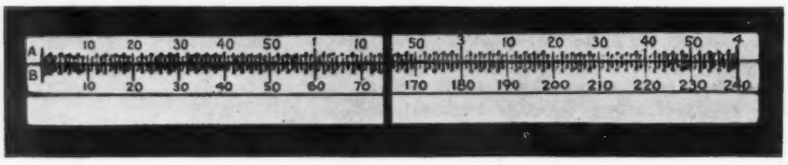
•

Specifications for Manhole Chimneys



Manhole chimneys extending from the manhole ceiling to the base ring of the cover can be constructed either of radially laid brick or of concrete not less than 6 in. radial thickness. The cross-section must be of the same shape as the cover frame, generally circular for roadway manholes and square for sidewalk manholes. It should have the same inside diameter as the inside diameter of the base cover frame if the chimney is 2 ft. or less in height.

If the chimney is more than 2 ft. in height the size of the opening at the bottom is generally increased 3 in. for every additional foot in height, with a maximum increase of 1 ft. A chimney more than 3 ft. in height is generally provided with galvanized iron sewer steps, spaced 12 in. center to center to within 12 in. of top of cover. These specifications have been found economical and practical by the Detroit Edison Company.



Lamp outage and trouble call time readable from slide rule

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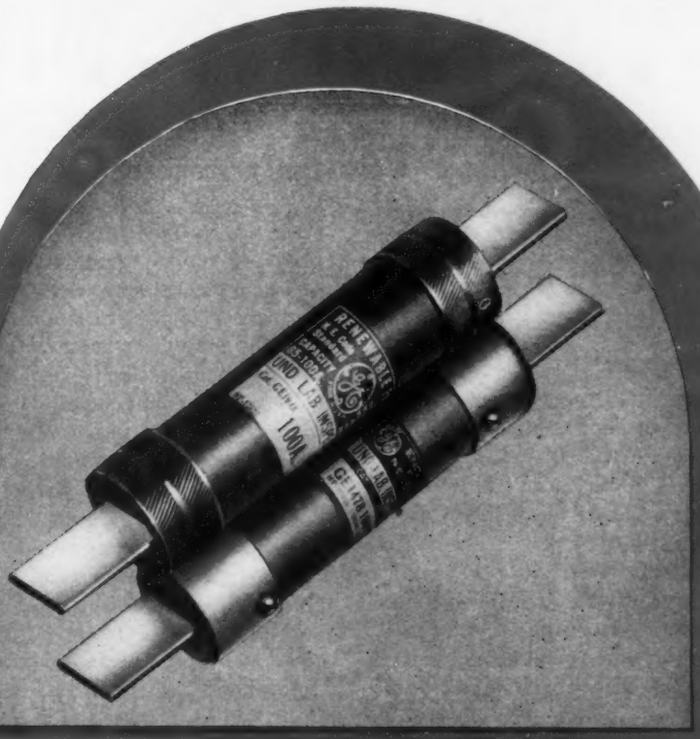

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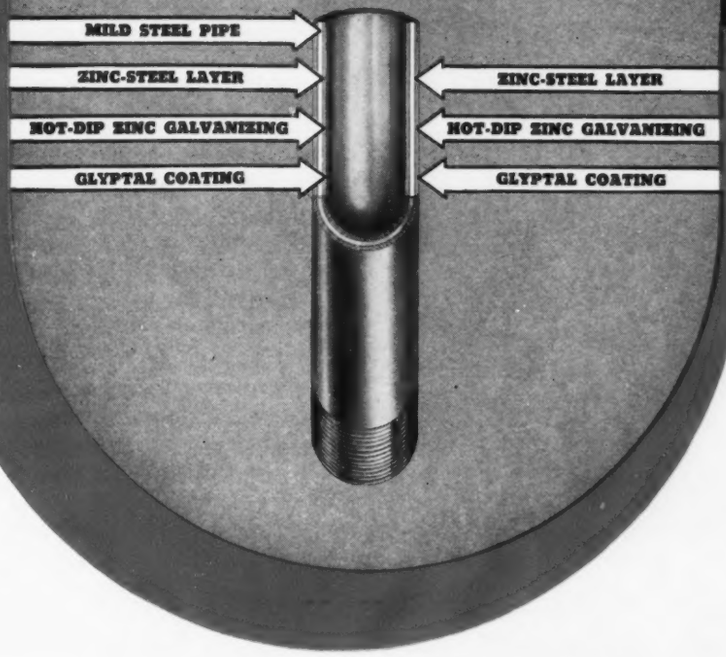

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Remodeling Trends in Industrial Plants

Data on 454 manufacturers' generating plants in fourteen major industries have been compiled by *Power*.* They have 1,032,000 kva. installed and 810,000 kva. in operation (about 10 per cent d.c.) developing a little over 2½ billion kw.-hr. An additional 780,000,000 kw.-hr. is purchased, or 25 per cent of the total. These plants represent about 10 per cent of all industrial private generating-plant capacity, judged by prime-mover horsepower, but include the larger and possibly the more progressive concerns. For this reason the figures and observations should be considered as applicable only to such plants and do not represent averages of industry that can be compared with census figures covering many small capacity plants as well.

Regarding age of generating equipment, 53 per cent of these 454 plants' capacity is over ten years old. Only two groups—rubber, and petroleum and coal products—report none over twenty years old, and these two groups of plants have 79 per cent and 70 per cent, respectively, of their capacity in units less than ten years old. Other groups that have a relatively high percentage of capacity in the newer equipment include stone, clay and glass and chemical. All other plants reporting have from 41 to 69 per cent of their capacity in units over ten years old.

Modernization has certainly been overlooked, according to these figures. While some of these plants may have sufficient waste heat or use enough process steam to justify generating part of their power, it appears that the conditions are very favorable to the purchase of more power, interchange of power with utilities, and modernization.

Regrettably the figures do not show the extent of power interchange with utilities, but the ratio of purchased power to generated power is given. For example, three groups of these plants — rubber, non-ferrous metals and machinery—purchase more than they generate, the ratio of purchased to generated power being 156, 125 and 113 per cent, respectively. The petroleum and coal-products group of plants purchases practically as much as it generates, despite the availability of fuel. Other plants rank as follows for per cent of purchased power: Transportation equipment, 70 per cent; chemical, 44; stone, clay and glass, 40; textile, 31; miscellaneous, 24; paper, 22; leather, 17; iron and steel, 14; food, 15; forest products, 4.

Inasmuch as these data show that some industries which might be expected to favor private generation have found it advantageous to purchase a large part of their power, it is rather surprising that others not so favorably situated should use such a small percentage of purchased power. Why should food industries use next to the smallest percentage of purchased power? Possibly it is due to the fact that 85 per cent of the food plants reporting on process steam indicate they use it. A high percentage of process steam users are also found in the following fields: Paper, 100 per cent; chemical, 100; rubber, 100; textile, 98; leather, 88; petroleum and coal products, 82. Others range from 70 to 13 per cent and are in the following order: Stone, clay and glass, iron and steel, forest-products, machinery, transportation equipment, miscellaneous and non-ferrous metals.

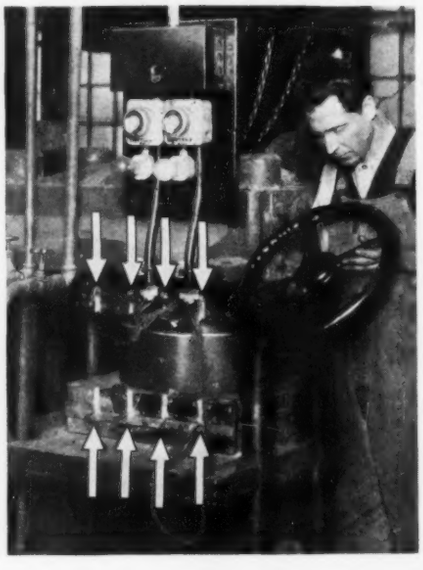
Plans for remodeling

Out of these 454 industrial plants, 16.3 per cent report the intention of remodeling their power facilities within one year, 28.9 per cent within two years and 9 per cent more probably within the latter period. Of course these intentions must be considered in the light of average age of equipment, but the textile, food, rubber and iron and steel groups show the highest recognition of the economy of change, with 18 to 21 per cent indicating intention of remodeling within a year. The transportation-equipment group stands out as showing the least intention of change, but this is possibly due to the fact that automobile and airplane factories are constantly modernizing.

Improvements contemplated within the next two years, according to number of plants reporting, rank in the following order so far as changes are concerned. Steam generation, 21 per cent; power generation, 18; pumping, 13; heating and ventilation, 7; refrigeration, 4; air conditioning, 4. It is rather surprising that with industrial experience obtained so far air conditioning isn't considered by more. Three industries stand out for intention to incorporate air conditioning—paper, rubber and chemical—14, 13 and 10 per cent, respectively, reporting the intention. The low percentage of textiles (5 per cent) contemplating

*December 15, 1934, issue.

Molds Wheels With Electric Heat



Automobile steering wheels are being molded with electric heat these days. In this particular installation eight strip heaters which heat the plates to a temperature around 400 deg. F. are inserted, four in the top plate and four in the bottom of a press which applies up to 1,000-lb. pressure to cure the composition used in manufacture of steering wheels.

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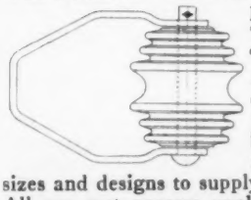

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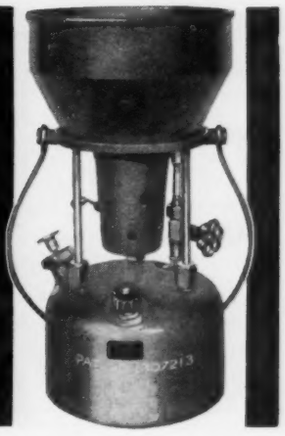

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this improvement is possibly due to the fact that many of them have already found air conditioning essential to production and applied it. Stone, clay and glass, food and miscellaneous industries are the only other groups to report this contemplated improvement. How many other plants have considered the effect of air conditioning on production and efficiency of workmen is not known.

Nearly seven times as many companies will make the proposed changes step-by-step as those contemplating simultaneous overhauling.

Again, it must be warned that these observations cover the reports of 454 large and possibly the more progressive plants, and must not be compared with averages obtained from U. S. Census figures including small plants.

•

Weld 0.005-In. Tantalum Sheets

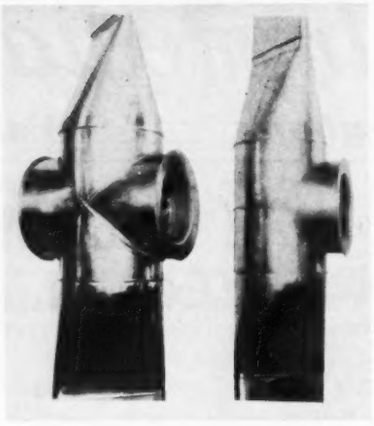
Tantalum sheets, worth $50 a pound and so thin that it takes 200 of them to make an inch, are now being arc welded regularly in the fabrication of chemical equipment. Fansteel Products, Inc., Chicago, one of the largest suppliers of tantalum, developed and perfected the method, thereby increasing the field of usefulness of this metal.

Some of the most important factors which must be considered in working with this metal are:

1. Inasmuch as most of the articles are custom made, the labor cost is rather high. Spoilage must therefore be reduced to a minimum.
2. Finished welds must be strong, ductile and both gas- and liquid-tight under pressure and vacuum.
3. Tantalum cannot be deposited from an electrode without so embrittling the welds as to make them unusable.
4. Tantalum cannot be heated in air much above 650 deg. F. without becoming hard and brittle.
5. The melting point of tantalum is above 5,100 deg. F.

The welding technique finally adopted consists of first forming a straight angle flange at all edges of the sheets to be arc welded. These flanges are then fitted together and tack welded. Then the job is immersed in a tank filled with carbon tetrachloride so that the edge to be welded is approximately $\frac{1}{4}$ in. below the surface of the liquid.

Immersion in carbon tetrachloride requires higher voltage across the arc than would be needed in air, and at the same time the thinness of the stock



Tantalum sheets only 0.005 to 0.025 in. thick electrically welded in this chemical equipment

and the necessity for strict localization of the heat demand low welding current. Hard-carbon electrodes, $\frac{1}{8}$ in. in size and gripped in small light electrode holders, are used. The welding current must be of normal polarity. Stability of the arc, ease of striking and freedom from blowing are absolutely essential for producing good welds. An open circuit voltage of 50, which falls to about 25 across the arc, usually produces satisfactory welds. Current depends on the thickness of metal, 0.005-in. stock requiring only 15 amp. and 0.025-in. 60 amp.

Welding is accomplished by melting the edges of the flanges so that the metal runs together. This must be accomplished quickly, since holding the arc in one spot or striking it more than once in one place is likely to result in brittle welds. Welding equipment manufactured by the Lincoln Electric Company, Cleveland, Ohio, is used in this work.

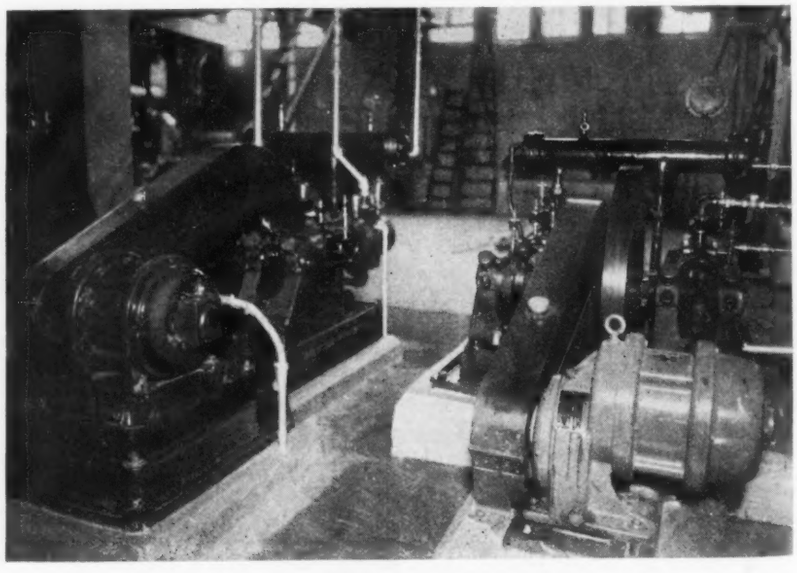
While it is apparent that special technique and considerable care are essential in arc welding tantalum, very satisfactory work is being done regularly on both large and small jobs.

•

Geared Unit Saves Investment

Two compressor installations in the plant of the Rainier Brewery, San Francisco, Calif, have the same capacity and operate at the same speed. One, installed several years ago (left), is chain-driven by a $7\frac{1}{2}$-hp., 900-r.p.m., a.c. motor, the driving sprocket being keyed directly on the motor shaft. The new installation (right) is also chain-driven, but through a modern reducing gear unit motorized by a $7\frac{1}{2}$-hp., 1,800-r.p.m., a.c. motor. The speed reduction of the unit of approximately 3:1 provides a shaft output speed of approximately 600 r.p.m. for driving the sprocket.

Every bit as compact, the motorized gear reduction unit permitted not only a modest saving over the first cost slower speed motor but also considerable savings in the chain drive itself because of the lower sprocket speed. Gear reduction units are rapidly gaining in favor for industrial drives of this type because of the savings possible through their application and low maintenance costs. Also, the use of high-speed, stock sizes of motors permits quick replacement.



Gear-drive motor found superior to sprocket drive

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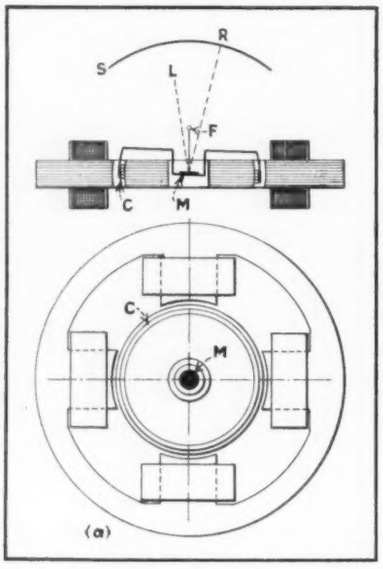
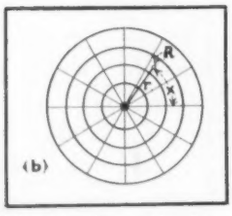
McGRAW-HILL BOOK CO., INC., 330 W. 42D ST., NEW YORK, N. Y.

Value and Phase on One Instrument

Simultaneous indication of both magnitude and phase relation on a spherical scale is possible on a new laboratory instrument described in the *Electrotechnische Zeitschrift* for October 25, 1934.





Tilt and subsequent rotation of moving coil give radial displacement, *r*, proportional to magnitude and angular displacement, *x*, proportional to phase relation on spherical scale (b).

Magnitude and phase angle on single spherical scale

A small, four-polar stator receives a.c. excitation in synchronism with the measured value, producing a rotating field toward an inner, concentric and stationary core. Within the narrow air gap between rotor and stator is located the annular moving coil *C*, through which is passed the current to be measured. This coil is suspended by a short wire *F*, so that the suspension point is above its center of gravity. It may also be held by a ball-bearing arrangement, permitting free rotation and inclination.

Torque is exerted upon the moving coil, proportional to the current and its phase relation to some reference value. The current will cause a tilt and its phase position will then cause a rotation. The light from a stationary lamp and lens system *L* is directed onto a horizontal mirror *M*, fastened to the moving coil, whence the light beam is reflected to a spherical ground glass *S*, on which is drawn a polar co-ordinate scale. The instrument is sensitive.

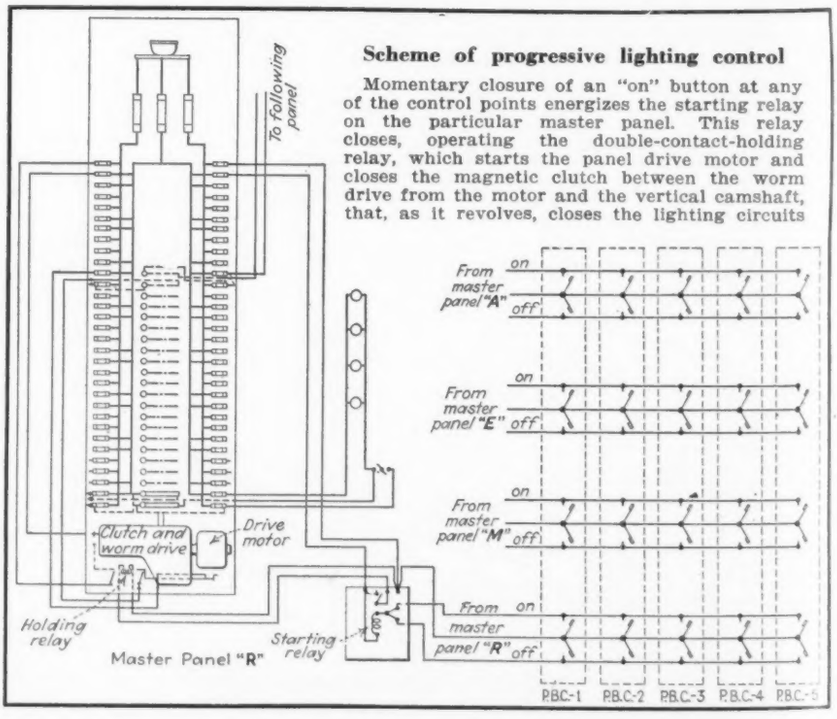
•

Multi-Point Control for Flexible Lights

From any one of five points, each a small panel of four double, momentary-contact push buttons arranged just like any usual gang of switches set in the wall, the entire 884-kw. lighting load in the main exhibit room of the Edison Institute Museum at Dearborn, Mich.,* can be controlled. This single room is 442 ft. wide, 800 ft. long and is divided into nineteen crosswise bays by rows of columns supporting the roof. The lighting is all indirect from continuous coves on each side of each bay except at bay ends, where direct units are installed. In the installation are 2,810 lamps, mostly of 300 and 500 watts.

All bay sections are equipped with switches on the building columns, so that any bay section or number of sections anywhere in the area can be lighted independently of the rest. The remote control functions as a by-pass of the local switching and is wholly unrelated to it. This is to say that any area may be illuminated when the

*We are indebted to C. Voorhees, electrical engineer, engineering laboratory, Ford Motor Company, for the information and illustrations presented in this article.



Scheme of progressive lighting control

Momentary closure of an "on" button at any of the control points energizes the starting relay on the particular master panel. This relay closes, operating the double-contact-holding relay, which starts the panel drive motor and closes the magnetic clutch between the worm drive from the motor and the vertical camshaft, that, as it revolves, closes the lighting circuits in definite sequence. The camshaft is rotated against the torque of a flat coil spring at its upper end. When the camshaft has made about one revolution, closing all of the lighting circuits, the last cam opens the motor circuit.

The shaft is held in the position where it stopped, since the tightened spring cannot move the worm drive backward. One of the circuits closed by the rotation of the camshaft runs to the next control panel, setting it in motion and it in turn the next, and so on until all five have closed all their circuits. Pushing the associated "off" button at any one of the five control points opens the starting relay, deënergizing the holding relay and thus the clutch between the worm drive and the camshaft of the master panel. The spring returns the camshaft to the "off" position when the clutch releases and, in turn, the operation is repeated on the four following panels.

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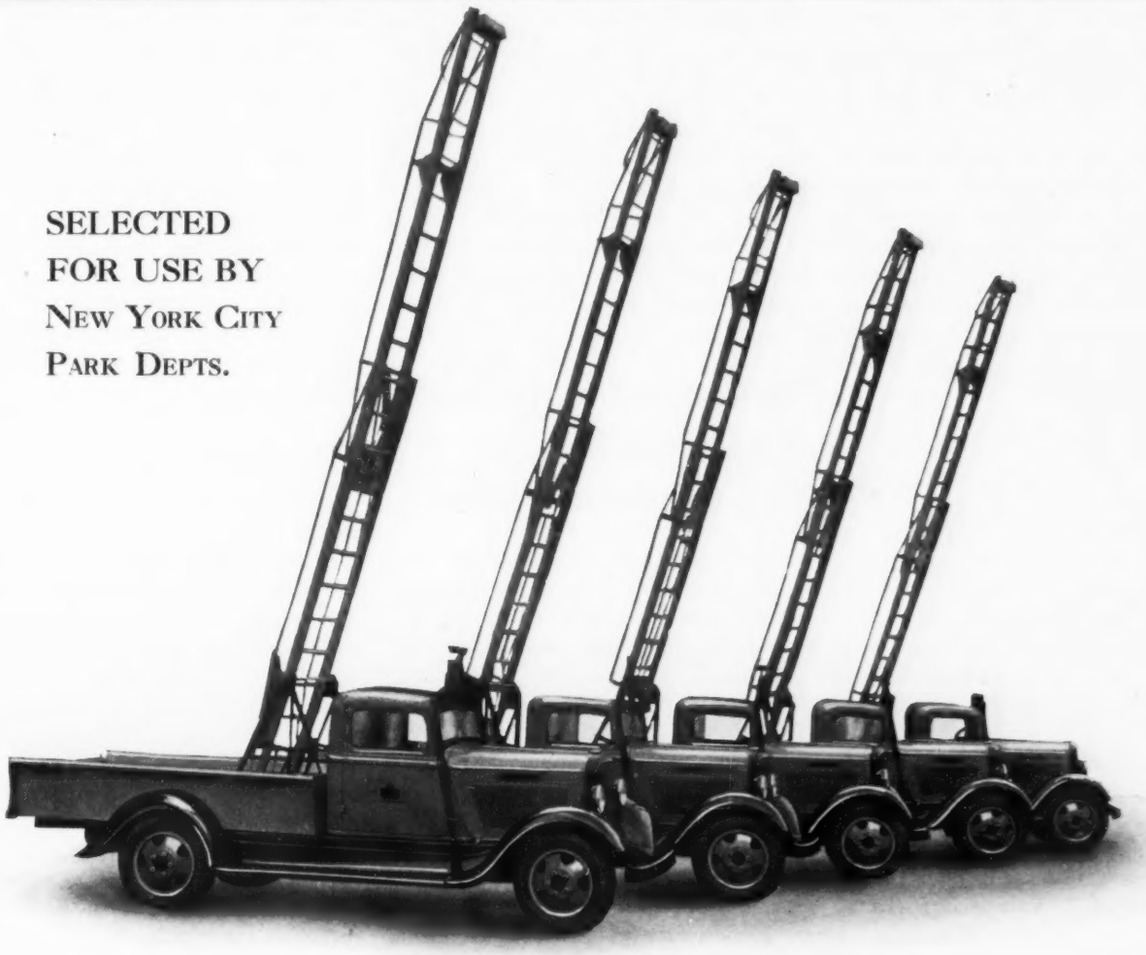
PARK DEPTS.



MURRAY DEMOUNTABLE CROWSNEST WINS RECOGNITION IN NEW YORK CITY

$225 F.O.B. B'KLYN

Low first cost, low upkeep cost, combined with all-round practical value—that's the basic reason why the fleet of Murray Crowsnests shown above was specified for Park Department Service in the five City Boroughs.

In design and construction, the Murray is a ladder rig of outstanding advantages. One man can operate it—set it up in a minute. It can be easily and safely mounted on any light commercial truck to give over 100 working positions.

In the service of leading utility companies, with city police and park departments, at exhibitions and fairs, the Murray Crowsnest is earning an enviable reputation. Send for booklet.

METROPOLITAN DEVICE CORP.
BROOKLYN, NEW YORK

Metropolitan Device Corp'n, Brooklyn, N. Y.

Gentlemen:

Without obligation, please send me your 16-page close-up booklet showing the Murray Demountable Crowsnest in action.

NAME .....
TITLE .....
COMPANY .....
ADDRESS .....

remote control is operated to light all or any quarter of the whole area. Then, when the remote control goes off, the areas that previously were lighted by local switching remain as they were.

As stated, the total lighting load in this room is about 900-kw. To throw such a load on and off in a single block would result in an abnormal current inrush, making a single circuit breaker impractical. Since individual by-pass circuits had to be installed for all local switches it was simpler and more economical to group these circuits at several points and put separate contact devices on each one, operating these devices in sequence by a motor-driven camshaft, than to bring them all together at one point to a single switch. Also, the sequence operation of the contact devices imposes the load on the supply transformers in a series of comparatively small steps instead of in one chunk, as would be done by a single breaker.

Twenty automatic control panels are spaced along the east and west walls of the building, ten on a side. These panels are divided into four groups of five, each group controlling the lighting of its adjacent quarter of the total floor area. The first or master panel of each group (*A*, *F*, *M* and *R* on the plan) contains a master relay and the four remaining panels in the group are successively set in operation by the one preceding, as is indicated by the accompanying panel diagram. From each first panel of the four groups are carried out three conductors running to the five paralleled push button control locations near to the five entrances to the room on the east side. There are thus four sets of "on" and "off" buttons at each of the five locations and from any one of them the lighting in the whole room may be controlled.

•

Industrial Sub Near Mass Production

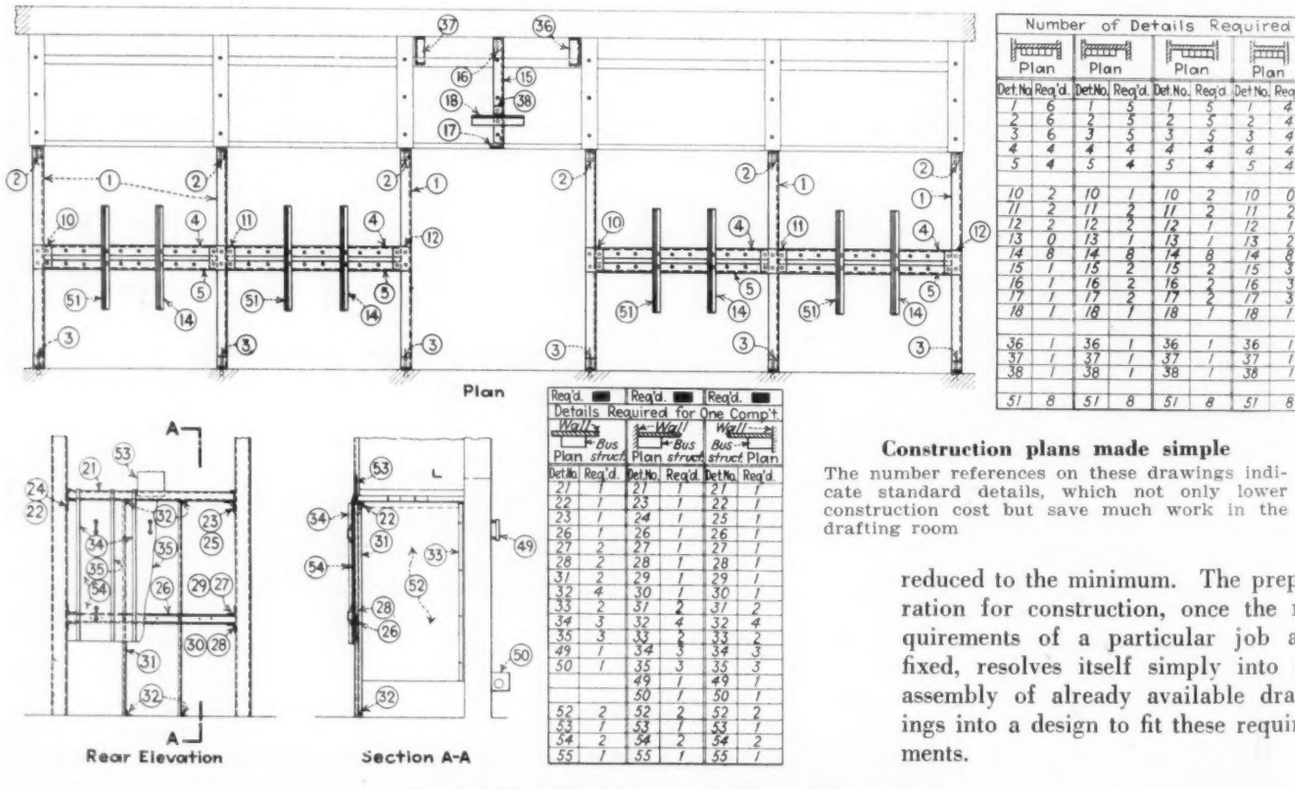
By RICHARD BANZ
Chicago, Ill.

Extensive revisions in design and practice relating to substations on customers' premises have recently been made by the Commonwealth Edison Company, Chicago. Service to large industrials is at 12 kv., in most cases from loop systems to insure as great a measure of energy supply continuity as is possible. The loop system operating at a fairly high voltage in an area like Chicago, where large potential concentrations of short-circuit current exist, requires that extreme care be given to the problems of industrial substation design and operation. This results in a type of construction considerably above what might be considered the average of good practice.

Yet the cost of the Commonwealth Edison construction has been kept very much lower than would be expected from the difference between it and commoner types. The number of customers served by the company from its 12-kv. loops is very large. This has allowed the company to carry further and to profit more from the idea of standardizaton than is possible to most other electricity supply systems. From the standardization of equipment and construction design down to the smallest details evolves the ability to do a necessarily very high grade of work at a cost that in the circumstances is surprisingly low.

The extent to which standardization has been carried is apparent from the sample structural drawings here reproduced. The larger drawing shows the plan of a five-position structure and the smaller an elevation and section of one of the positions. Dimensions and certain other details have been deleted for clarity of reproduction so as to leave more apparent the reference numbers that indicate standard parts and design details. It is to be noted that the number of references on these drawings runs up to 55, each one of which identifies a standard part on hand in stock or a method of construction for which specially designed equipment, such, for instance, as portable concrete forms, is available.

When a new job is to be done engineering and drafting room work is reduced to the minimum. The preparation for construction, once the requirements of a particular job are fixed, resolves itself simply into an assembly of already available drawings into a design to fit these requirements.



Construction plans made simple
The number references on these drawings indicate standard details, which not only lower construction cost but save much work in the drafting room

PRODUCT INDEX

AIR COMPRESSORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

AIR-CONDITIONING EQUIPMENT
Frigidaire Corp., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Kelvinator Corp., Detroit, Mich.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

AMMETER, CLIP-ON
Columbia Elec. Mfg. Co., Cleveland, Ohio
Ferranti, Inc., New York, N. Y.

ANALYSES, REVENUE
Recording & Statistical Corp., New York, N. Y.

ANCHORS, GUY
Chance Company, Centralia, Mo.
Everstick Anchor Co., Fairfield, Iowa.
Hubbard & Co., Pittsburgh, Pa.
Kearney Corp., James R., St. Louis, Mo.
Line Material Co., South Milwaukee, Wis.

APPLIANCES, HEATING
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., New York, N. Y.

BATTERIES, STORAGE, ALL APPLICATIONS
Electric Storage Battery Co., Phila., Pa.
Gould Storage Battery Co., Depew, N. Y.

BATTERIES, STORAGE, AUTOMOTIVE
Firestone Tire & Rubber Co. Akron, Ohio.

BATTERY CHARGING APPARATUS
General Electric Co., Schenectady, N. Y.

BEARINGS, ROLLER
Timken Roller Bearing Co., Canton, Ohio.

BLOCKS, LINEMEN'S CABLE STRINGING
Western Block Co., Lockport, N. Y.

BOILERS, STEAM
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N. Y.

BOXES, FUSE
G & W Elec. Specialty Co., Chicago, Ill.
General Electric Co., Bridgeport, Conn.

BRACES & STRAIN INSULATORS, WOOD
Hubbard & Co., Pittsburgh, Pa.

BRACKETS & WIREHOLDERS, INSULATED
Hubbard & Co., Pittsburgh, Pa.

BRUSHES, CARBON
National Carbon Co., Cleveland, O.

BURNERS, OIL, GAS, PULVERIZED FUEL
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N. Y.

BUS BAR SUPPORTS
Burndy Engineering Co., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Pacific Elec. Mfg. Corp., San Francisco, Cal.
Schweitzer & Conrad, Inc., Chicago, Ill.

BUS BARS & TUBES
American Brass Co., Waterbury, Conn.

CABLE, ELECTRIC
American Elec'l Works, Phillipsdale, R. I.
American Steel & Wire Co., Chicago, Ill.
Amaconda Wire & Cable Co., New York, N. Y
Crescent Ins. Wire & Cable Co., Trenton, N. J.
General Cable Corp., New York, N. Y.
General Electric Co., Schenectady, N .Y.
Kerite Ins. Wire & Cable Co., New York, N. Y.
Okonite Co., Passaic, N. J.
Okonite-Callender Cable Co., Passaic, N. J.
Rockbestos Products Corp., New Haven, Conn.
Roebling's Sons Co., J. A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.
United States Rubber Co., New York, N. Y.

CABLE, STEEL STRAND
American Steel & Wire Co., Chicago, Ill.
Indiana Steel & Wire Co., Muncie, Ind.
Roebling's Sons Co., J. A., Trenton, N. J.

CABLE ACCESSORIES
G & W Elec. Specialty Co., Chicago, Ill.
General Cable Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Line Material Co., South Milwaukee, Wis.
Metropolitan Device Corp., Brooklyn, N. Y.

CABLE END BELLS
G & W Elec. Specialty Co., Chicago, Ill.

CABLE FIREPROOFING
Johns-Manville Corp., New York, N. Y.

CAPACITORS
General Electric Co., Schenectady, N. Y.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

CHOKE COILS
American Transformer Co., Newark, N. J.
General Electric Co., Schenectady, N. Y.

CIRCUIT BREAKERS, CARBON
I-T-E Circuit Breaker Co., Philadelphia, Pa.

CIRCUIT BREAKERS, OIL AND AIR
Condit Electrical Mfg. Corp., Boston, Mass.
General Electric Co., Schenectady, N. Y.
Pacific Elec. Mfg. Corp., San Francisco, Cal.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

CIRCUIT BREAKERS, THERMAL
I-T-E Circuit Breaker Co., Philadelphia, Pa.

CLAMPS, CABLE
Brewer-Titchener Corp., Cortland, N. Y.

CLAMPS, GUY
Hubbard & Co., Pittsburgh, Pa.
Kearney Corp., James R., St. Louis, Mo.

Standing Timber to Sturdy Poles

POLES PILING

Weyerhaeuser

CARE Goes All the Way

CARE in the selection of fine straight Red Cedars in Weyerhaeuser's stands of virgin western timber. CARE in peeling, seasoning, trimming, treating, storing, loading and shipping of sound, serviceable poles.

Every step in the process is performed with experience and skill. Large stocks of finished seasoned poles are carried at convenient storage yards for quick delivery.

The whole story of Weyerhaeuser Western Red Cedar poles is interesting and important to you who are concerned with economy and extreme durability in line construction. Write for your copy of the booklet describing Weyerhaeuser poles.

POLE AND PILING DIVISION

Weyerhaeuser Sales Company

Executive Offices

FIRST NATIONAL BANK BUILDING, SAINT PAUL MINNESOTA

Branch Offices

Tacoma Building, Tacoma, Washington
P. O. Drawer 629, Newark, New Jersey
1024 Old National Bank Building, Spokane, Washington

ALSO REPRESENTED BY WESTINGHOUSE ELECTRIC SUPPLY CO.
Detroit Chicago St. Louis

BUILDING UP THE LOAD

APPLIANCES, LIGHTING AND POWER • DOMESTIC • COMMERCIAL • INDUSTRIAL

3-Second Selling by Show Window Lighting

By J. M. KETCH
General Electric Company,
Nela Park, Cleveland

Persons walking along a street pass by the average show window, unless attracted or impeded in their progress, in about three seconds. All are prospective buyers, even though they are not out seeking to make purchases. If they are headed to some destination to make a purchase they can be attracted and sold something they did not originally set out to get by proper window displays. A merchant's problem is to secure money before it is spent elsewhere. Every one selling anything is his competitor.

Three seconds is available to attract and sell an idea, product or service. It can be done, as exemplified by 60-mile-per-hour selling of some roadside signs.

Light properly and adequately used is the first essential, for several reasons. Human beings are attracted by light, when effectively used, the same as moths. Besides, psychologists say that sight is the primary function employed in making selection, although sentiment, logic, etc., may come in if time is allowed. The second essential for making a show-window attract and sell in three seconds is the emphasis of one idea or product, or very closely related products, to avoid distraction or confusion.

The idea, product or service to be sold should be silhouetted against a contrasting background and spotlighted with high-intensity white illumination. One-half of the total show-window light should be used for this purpose and the remainder for general lighting, which may be colored.

High stopping and selling power can be afforded by showcases and displays inside the store by applying the same principles. Every space, or niche, even back of and above counters, can be made supplementary show windows by proper lighting. Light can be used in single-aisle stores to attract attention to merchandise at the sides. In multiple-aisle stores it can be used to attract customers down one aisle and back another. Unfrequented sections can be made to attract customers, if light is used psychologically.

•

Employees Aid in Building Business

The first six months of an employee business-building program by the Wisconsin Public Service Corporation has produced the following concrete results:

6,405 prospect cards have been turned in.
1,676 major appliances have been sold on prospect cards.
$135,000 worth of appliances have been sold.
$36,000 in additional gross revenue was added by the sale of the 1,676 major appliances.

O. C. Roehl, sales manager for the company, says the program is more than paying its way and that the spirit of the employees has been improved. Also, better public relations have resulted from the fact that these volunteer salesmen have been trying to sell the value of the service in the terms the customer can understand.

Air Conditioning for Medical Center

A lead gained from a doctor's request for information on air conditioning has been developed into the first completely air-conditioned building in Pasadena, Calif. Frank James, salesman for C. M. Sayers, Frigidaire dealer in Pasadena, received the inquiry for air-conditioning information and reasoned that if one doctor was interested in the subject other doctors also would appreciate knowing about the benefits of conditioned air. Immediately he started a campaign, calling on doctors and outlining his plans for a completely air-conditioned Medical Arts Building to be occupied only by members of the medical profession.

That there is a need for comfortable professional offices is evidenced by the fact that no difficulty was experienced in interesting a sufficient number of doctors to make the building practical. A progressive realtor was called in and agreed to make the investment.

The building was recently completed, one story with a basement and housing fourteen suites averaging three rooms each. Heating and cooling are provided by a central air-

Medical Center promoted by air-conditioning salesmen

PRODUCT INDEX

CLAMPS, TAP-OFF
Tips Tool Co., Taylorville, Ill.

CLIPS, GROUND WIRE
Kearney Corp., James R., St. Louis, Mo.

CLUTCHES, MAGNETIC
Cutler-Hammer, Inc., Milwaukee, Wis.

COMMUNICATION EQUIPMENT
Western Electric Co., New York, N. Y.

COMMUTATOR RESURFACERS
Ideal Commutator Dresser Co., Sycamore, Ill.

CONDENSERS, STATIC
Acme Wire Co., New Haven, Conn.

CONDENSERS, STEAM
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

CONDENSER TUBES
American Brass Co., Waterbury, Conn.

CONDUIT, ASBESTOS-CEMENT
Johns-Manville Corp., New York, N. Y.

CONDUIT, FIBRE
Fibre Conduit Co., Orangeburg, N. Y.
General Electric Co., Bridgeport, Conn.
Graybar Electric Co., New York, N. Y.
Line Material Co., South Milwaukee, Wis.

CONDUIT, METALLIC
American Brass Co., Waterbury, Conn.
General Electric Co., Bridgeport, Conn.
Graybar Electric Co., New York, N. Y.

CONDUIT STRAPS
Kearney Corp., James R., St. Louis, Mo.

CONNECTORS, SOLDERLESS
Burndy Engineering Co., New York, N. Y.
Electroline Company, Chicago, Ill.
Fargo Mfg. Co., Poughkeepsie, N. Y.
General Electric Co., Schenectady, N. Y.
Kearney Corp., James R., St. Louis, Mo.
Line Material Co., South Milwaukee, Wis.
Railway & Industrial Engrg. Co., Greensburg, Pa.
Reliable Electric Co., Chicago, Ill.
Sherman Mfg. Co., H. B., Battle Creek, Mich.

CONNECTORS, TINNED COPPER
National Telephone Supply Co., Cleveland, O.

CONSTRUCTION SERVICE
Hoosier Engrg. Co., Chicago, Ill.
Stone & Webster Engrg. Corp., Boston, Mass.

CONTROL, MOTOR
Allen-Bradley Co., Milwaukee, Wis.
Condit Elecl. Mfg. Corp., Boston, Mass.
Cutler-Hammer, Inc., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland, O.
Square D Co., Milwaukee, Wis.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

CONTROLS, AUTOMATIC
Mercoid Corp., Chicago, Ill.
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

COOKING EQUIPMENT, COMMERCIAL
Edison G. E. Appliance Co., Chicago, Ill.

CORDS, HEATER
American Steel & Wire Co., Chicago, Ill.
Driver-Harris Co., Harrison, N. J.
General Cable Corp., New York, N. Y.
General Electric Co., Bridgeport, Conn.
Okonite Company, Passaic, N. J.
Rockbestos Products Corp., New Haven, Conn.
United States Rubber Co., New York, N. Y.

CROSSARMS
Graybar Electric Co., New York, N. Y.

CUBICLES
Condit Elecl. Mfg. Corp., Boston, Mass.

CUTOUTS
Condit Elec'l Mfg. Corp., Boston, Mass.
G & W Elec. Specialty Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Kearney Corp., James R., St. Louis, Mo.
Line Material Co., South Milwaukee, Wis.
Railway & Industrial Engrg. Co., Greensburg, Pa.
Schweitzer & Conrad, Inc., Chicago, Ill.

DETECTORS, VOLTAGE
Schweitzer & Conrad, Inc., Chicago, Ill.

DISCONNECT PLUGS
Metropolitan Device Corp., Brooklyn, N. Y.

DRAFTING ROOM EQUIPMENT & MATERIALS
Bruning Co., Charles, New York, N. Y.

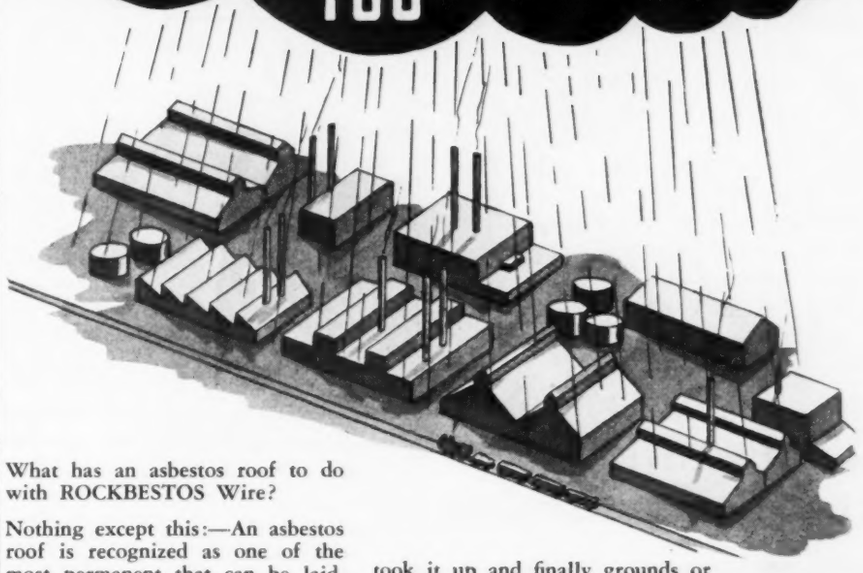
ECONOMIZERS, FUEL
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N. Y.
Superheater Co., New York, N. Y.

ELEMENTS, HEATING
General Electric Co., Schenectady, N. Y.
Wiegand Co., Edwin L., Pittsburgh, Pa.

ENAMELS
Sherwin-Williams Co., Cleveland, Ohio.

ENGINES, INTERNAL COMBUSTION
Sterling Engine Co., Buffalo, N. Y.

ASBESTOS ON WIRES *can be Moistureproof* TOO



What has an asbestos roof to do with ROCKBESTOS Wire?

Nothing except this:—An asbestos roof is recognized as one of the most permanent that can be laid. Obviously to have this reputation it must have established a record of successfully resisting moisture as well as heat, cold, light and age.

Mechanical men, as far as we can find out, never hesitate to lay an asbestos roof even though they know that raw asbestos takes up moisture. They appreciate the part that impregnation plays.

Yet we still meet electrical men who hesitate to install ROCKBESTOS wire in conduit for that reason.

Now, we know why they feel that way. Their objection is usually based on experience with early forms of asbestos wires. These had one or two braids or wrappings of asbestos yarn and it is impossible to make a permanently moistureproof covering out of a latticed structure like this. Naturally when these wires were installed in conduit, where there is usually some moisture, the covering gradually took it up and finally grounds or short circuits resulted.

But ROCKBESTOS wire is not and never has been made this way. ROCKBESTOS A.V.C. insulation consists of a heavy belt of dense, *felted* asbestos which is completely impregnated with inert heatproof and moisture resisting insulating compounds—entirely unlike the old-fashioned braided or yarn wrapped covering. Embedded in this belt of felted asbestos is a high dielectric insert of varnished cambric to provide a still greater margin of dielectric safety under wet conditions.

We urge any engineer who appreciates the advantages of a ROCKBESTOS insulated wire in permanence, yet who is doubtful about putting it in conduit, to permit us to submit samples and data concerning the performance of the several million feet of ROCKBESTOS A.V.C. wire and cable in conduit at the present time. ROCKBESTOS PRODUCTS CORPORATION, New Haven, Conn.

ROCKBESTOS
—the wire with permanent insulation

ROCKBESTOS PRODUCTS CORPORATION,
New Haven, Conn.

Your argument sounds reasonable. Let me have the information you offer.

Signed .....

Company .....

City..... State.....

conditioning installation which consists of a 10-hp. compressor, four 3-ton evaporators, one oil-fired boiler, a humidifier and the necessary fans, filters, thermostats and other instruments to provide complete automatic air conditioning for each suite of offices.

The comfort provided by proper air conditioning greatly increases their efficiency, according to the physicians now using these modern offices. It also has a very practical value in making it more comfortable for patients who are waiting. They wait more patiently and leave the office refreshed and feeling better. There is also great value for the power company because so many people are impressed with the benefits of air conditioning and then desire it in their own homes.

•

Utility Advisers Help Farm Customers

To familiarize rural customers with the advantages of electrical applications on the farm, the Southern California Edison Company has established a new agricultural advisory department. Each of the seven field representatives comprising the department is a specialist in electrical applications, trained in agriculture and thoroughly acquainted with the farming problems of the territory. Specialists are provided with an automobile equipped with demonstration equipment for the various applications of electricity on the farm, including brooding and incubating, dairy sterilization, refrigeration, insect control, lighting and other applications.

Already the farmers are coming to look upon these utility specialists as technical advisers. The new department is spreading good will and bringing in new revenue by its helpful service.

•

Many utilities have featured the well-known penny in their advertising, often with too much emphasis on the cent and too little on the service. Boston gives it another slant that is strong in selling.

•

Electrifies 850 Old Water Heaters

Nearly 850 range or furnace-heated water tanks in one territory in New York State were converted to electric operation between February 1 and October 1, 1934, by offering a 1½-cent heating rate and applying electric heating units, thermostats and insulated coverings to the old tanks. Each unit was converted in a few hours and at small cost, it has been reported.

In one case where two 120-gal. range tanks had been used they were converted by equipping each with a thermostatically controlled 2-kw. top heating element to take care of everyday service. Bottom elements, manually connected and thermostatically controlled, provide additional heat for wash days. At a draw-off rate of 7,400 gal. per month, 1,400 gal. of which is for the laundry, the first 22 days' operation showed a consumption of 1,275 kw.-hr. and a draw-off of 5,840 gal.

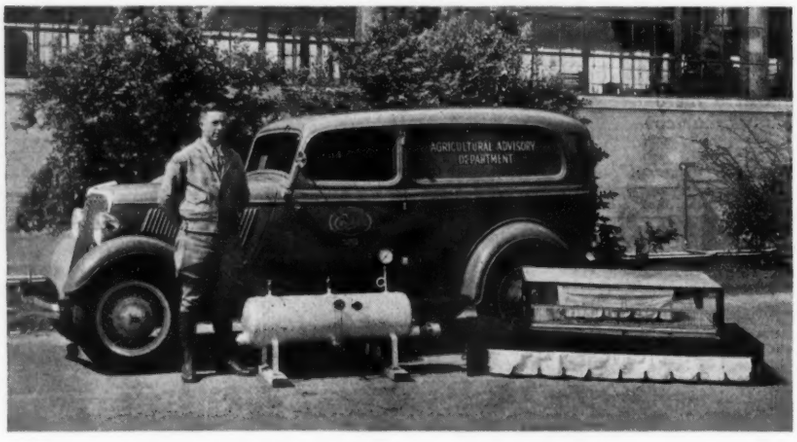
The conversion equipment used in these installations was furnished by the Hynes & Cox Electric Corporation.

•

10 Years Experience in Full-Use Home

In 1924 Prof. S. Parker Smith of the Royal Technical College, Glasgow, built a ten-room house which was fully electrified from the outset. In the October 19, 1934, issue of the *Electrical Review* (London) he summarizes the results of the two-rate (day and night) consumption for the decade. His daytime consumption has grown from 10,299 kw.-hr. in 1924-25 to 18,774 in 1933-34. The night usage decreased, meanwhile, from 6,043 to 4,167, due to more extensive use of water-heating energy in the daytime. The switch is now left almost continuously on the low rate (1 kw.) on this 4-kw. heater during the night.

For the ten-year period 69 per cent (12,688 kw.-hr.) of the average consumption was day use and the rest (5,664 kw.-hr.) was night use. A refrigerator, added in 1928, was the principal item of increased load. Rate reduction, both energy and fixed charge, give 24,000 kw.-hr. now for the same over-all cost of 16,000 in 1924-25. Professor Smith reports that room heating and water heating each are 40 per cent of the load, cooking 12½ per cent, lighting and small appliances 7½ per cent. Day load for the ten-year period represents 58 per cent of the cost, night load 20 per cent and fixed charge 22 per cent. A recent reduction to ⅜ pence will cut 10 pounds from the professor's 1933-34 bill of 45 pounds, 8 shillings, 8 pence.



Agricultural specialists of the Southern California Edison Company use automobiles equipped with demonstration equipment for electrical farm applications

PRODUCT INDEX

FANS
Wagner Electric Corp., St. Louis, Mo.

FENCE, PROTECTIVE
Cyclone Fence Co., Waukegan, Ill.

FITTINGS, COPPER CONDUCTOR
Burndy Engineering Co., New York, N. Y.
Railway & Industrial Engrg. Co., Greensburg, Pa.

FLARES, LINEMEN'S
Central Railway Signal Co., Newton, Mass.

FLOODLIGHTS
General Electric Co., Schenectady, N. Y.

FLOORINGS, OPEN STEEL
Blaw-Knox Co., Pittsburgh, Pa.

FURNACES, ELECTRIC HEAT-TREATING
Hoskins Mfg. Co., Detroit, Mich.

FURNACES, ELECTRIC MELTING
American Bridge Co., Pittsburgh, Pa.
Detroit Electric Furnace Co., Detroit, Mich.
General Electric Co., Schenectady, N. Y.

FURNACES, WATER-COOLED
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N. Y.
Superheater Co., New York, N. Y.

FUSES, HIGH TENSION
Kearney Corp., James R., St. Louis, Mo.
Line Material Co., South Milwaukee, Wis.
Pacific Elec. Mfg. Corp., San Francisco, Cal.
Schweitzer & Conrad, Inc., Chicago, Ill.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

FUSES, LOW VOLTAGE
General Electric Co., Bridgeport, Conn.

FUSE PULLERS
Kearney Corp., James R., St. Louis, Mo.

GATES, HEAD & SLUICE
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.

GAUGES, RECORDING
Bristol Co., Waterbury, Conn.

GEAR MATERIAL, NON-METALLIC
Continental-Diamond Fibre Co., Bridgeport, Pa.
General Electric Co., Schenectady, N. Y.

GEARS & PINIONS, FIBRE & FABRIC
Continental-Diamond Fibre Co., Bridgeport, Pa.
General Electric Co., Schenectady, N. Y.

GENERATORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

GENERATORS, STEAM
Babcock & Wilcox Co., New York, N. Y.

GROUND RODS
Bridgeport Brass Co., Bridgeport, Conn.
Metropolitan Device Corp., Brooklyn, N. Y.

GROUND FITTINGS
H. B. Sherman Mfg. Co., Battle Creek, Mich.

GROUNDING SETS
Kearney Corp., James R., St. Louis, Mo.
Tips Tool Co., Taylorville, Ill.

HOISTS
Coffing Hoist Co., Danville, Ill.

INSTRUMENT TRANSFORMERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Transformer Co., Newark, N. J.
General Electric Co., Schenectady, N. Y.
Sangamo Electric Co., Springfield, Ill.
Weston Elec'l Instrument Corp., Newark, N. J.

INSTRUMENTS, BOILER ROOM
Bristol Company, Waterbury, Conn.

INSTRUMENTS, ELECTRICAL INDICATING
General Electric Co., Schenectady, N. Y.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.
Weston Elec'l Instrument Corp., Newark, N. J.

INSTRUMENTS, GROUND TESTING
Biddle Co., James G., Philadelphia, Pa.
Borden Electric Co., Summit, N. J.

INSTRUMENTS, INSULATION TESTING
Biddle Co., James G., Philadelphia, Pa.

INSTRUMENTS, RECORDING
Bristol Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

INSTRUMENTS, RESISTANCE MEASURING
Biddle Co., James G., Philadelphia, Pa.

INSTRUMENTS, SCIENTIFIC AND TESTING
Bristol Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.

INSTRUMENTS, TELEMETERING
Bristol Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.

INSULATING MACHINERY
American Ins. Machy. Co., Philadelphia, Pa.

INSULATING MATERIAL, ASBESTOS
Johns-Manville Corp., New York, N. Y.

INSULATING MATERIAL, COMPOUNDS, PAINTS & VARNISHES
General Electric Co., Bridgeport, Conn.
Mica Insulator Co., New York, N. Y.
Sherwin-Williams Co., Cleveland, Ohio.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

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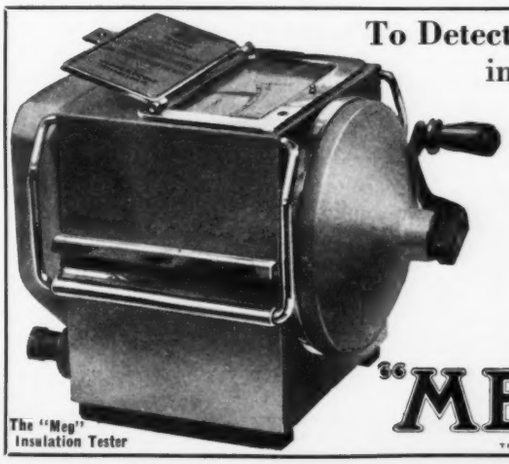

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LETTERS TO THE EDITOR

Attraction—Measure of Sphere-Gap Voltage

To the Editor of ELECTRICAL WORLD:

A news item in your much-alive ELECTRICAL WORLD (November 10, 1934, page 62) has called my attention to another striking instance of almost identical solution of a problem made by investigators on opposite sides of the world who have in no way exchanged ideas and seemingly have not had the slightest common sources of direction toward it. I refer to the abstract of studies reported by E. Heuter of the Darmstadt Laboratory in the *Elektrotechnische Zeitschrift* of August 23, 1934.

Prompted by the discussion in the meeting of the committee on high-voltage measurements at the Hot Springs convention of the A.I.E.E. last June, we set to work at our high-voltage laboratory to make a contribution toward the solution of this calibration problem. We have developed a method which has the advantage of a null measurement and thus does not require a change in spacing of the spheres to give the scale reading. A change of external force holds the spheres at constant separation and the measured force is an index of the voltage. Readings up to 700 kv. have been made and we find that all our readings up to this value may be duplicated at any time without making corrections for temperature, humidity or barometer.

The spheres used are 100 cm. The maximum force obtained was 315 grams at 55 cm. and 700 kv. The force-potential relation may be calculated by application of the theory of inverted images as presented in Lord Kelvin's paper on "Electricity and Magnetism" (page 96, paragraph 142). My associates, Jesse E. Hobson and Simon Ramo, expect to join me in presenting a thorough report on this technique to the A.I.E.E. in time for the summer convention at Ithaca.

ROYAL W. SORENSEN,
Professor of Electrical Engineering,
California Institute of Technology,
Pasadena.

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Missing Data on Tupelo

To the Editor of ELECTRICAL WORLD:

Does any significance attach to the fact that the article on Tupelo, given on page 30 of the current issue, is confined solely to operations *since* T.V.A. rates went into effect, and that there are no data and no mention whatever of results prior to that time? I do not know what such a comparison shows, but to me it would have great significance. When a man falls off a cliff it is interesting to note what progress he makes in climbing back, but in the final analysis the important question is not how well he does after the fall, but whether he ever gets back to where he was.

Apparently the residential revenue in September averaged $2.05 per customer. Was it as low as that before? The anti-utility, pro-municipal-ownership zealots always stress the increased consumption which can be obtained with very low rates, but they refrain from saying anything about the revenue, and with good reason, because the revenue is usually lower, although more service has to be furnished.

After finding out where we stand now as compared with where we were originally, it becomes incumbent to take stock of all the factors which affected the result, and not assign all of the result to any single factor such as a rate reduction. The distribution of federal funds to farmers and others has greatly increased buying power in recent months. The limited information available to me indicates greatly increased consumption in that section of the country, even in localities where rates have not been reduced. Low-priced appliances sold on easy terms and extensive ballyhoo must also have had considerable effect.

Obviously the T.V.A. has concentrated on Tupelo an amount of effort and expenditure out of proportion to the importance of the community, and it would be strange indeed if there were no substantial increases in consumption. Some one has said: "The T.V.A. is determined to prove that electricity can be furnished cheaply, no matter what it costs."

EDWARD J. CHENEY,
Consulting Engineer,
New York.

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Farmer Brown Proposes the EOF

To the Editor of ELECTRICAL WORLD:

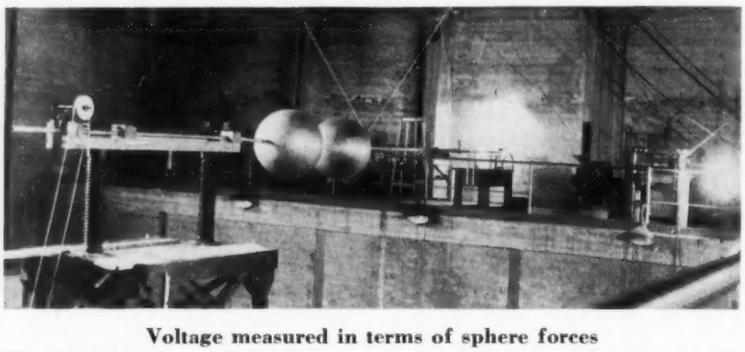
Good Farmer Brown, he went to town, to attend a booster meeting, and very much to his surprise, they called on him for a greeting. But he was ready—always was, for he was up and coming, and things about that farm of his, well, they were always humming.

Said he: "I came to listen to what other folks propose, and really had no notion of sticking in my nose. But since you've up and asked me I'll say, 'twixt me and you, that I really think the AAA has overlooked a thing or two. It's fine to boost the prices of the things we have to sell, and to try to make our income run more parallel with that of other industries, but I'm wondering, I say, why another of those initial things doesn't come our way.

"So I propose the EOF—'Electricity on the Farm.' I couldn't do without it. With it I light my barn. I thresh with it, I bale with it, and dig my postholes, too; and the Missus finds a lot of things for electricity to do. It runs the separator. It runs the patent churn. It keeps the woodpile well supplied with nice, dry wood to burn. It does the washing for her. It makes her ironing easy. And in the summer time a fan keeps the house cool and breezy. And sometimes we all load up and go to town for the first picture show, because we know it's easy, with electric light, to do the chores when we come home, most any time of night.

"And so I think the Brain Trust missed a right good bet, because they haven't played up my EOF as yet. But if they're half as smart as they pretend to be, they surely will initial farm electricity. To both the farmer and his wife it certainly is a boon, and so I hope the New Deal will boost my EOF quite soon."

L. S. MUNSELL,
Herington, Kan.



Voltage measured in terms of sphere forces

The right-hand (grounded) sphere is so suspended by four ropes as to avoid side sway. At the end of its shaft (on the gallery) is a band which runs over a vertical bicycle wheel to a weight pan. One-half gram or less on the pan will move the sphere. The null position of this swinging sphere is observed by means of a hair-line telescope. The left-hand (non-grounded) sphere is rigidly supported on insulators on a tower and is adjustable for gap spacing. In reading voltage, potential is applied to the spheres and sufficient weights added to the pan to keep the grounded sphere from moving toward the non-grounded one. The weight is a measure of force between spheres.

PRODUCT INDEX

INSULATING MATERIAL, FISH PAPER
Continental-Diamond Fibre Co., Bridgeport, Pa.

INSULATING MATERIAL, MICA
Continental-Diamond Fibre Co., Bridgeport, Pa.
Macallen Co., Boston, Mass.
Mica Insulator Co., New York, N. Y.

INSULATING MATERIAL, PHENOL FIBRE
Bakelite Corp., New York, N. Y.
Continental-Diamond Fibre Co., Bridgeport, Pa.
Synthane Corp., Oaks, Pa.

INSULATING MATERIAL, PORCELAIN
Imperial Porcelain Works, Trenton, N. J.

INSULATING MATERIAL, TREATED FABRICS & PAPER
General Electric Co., Bridgeport, Conn.
Mica Insulator Co., New York, N. Y.

INSULATING MATERIAL, VULCANIZED FIBRE
Continental-Diamond Fibre Co., Bridgeport, Pa.
Spaulding Fibre Co., No. Tonawanda, N. Y.

INSULATOR CAPS, DROP FORGED
Brewer-Titchener Corp., Cortland, N. Y.

INSULATOR PINS
Hubbard & Co., Pittsburgh, Pa.
Line Material Co., South Milwaukee, Wis.
Ohio Brass Co., Mansfield, Ohio

INSULATORS
Corning Glass Works, Corning, N. Y.
Graybar Electric Co., New York, N. Y.
Illinois Elec. Porcelain Co., Macomb, Ill.
Imperial Porcelain Works, Trenton, N. J.
Jeffrey-Dewitt Insulator Co., Kenova, W. Va.
Lapp Insulator Co., LeRoy, N. Y.
Locke Insulator Corp., Baltimore, Md.
Ohio Brass Co., Mansfield, O.
Owens-Illinois Glass Co., Muncie, Ind.
Porcelain Insulator Corp., Lima, N. Y.
Thomas & Sons, R., Lisbon, O.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.
Whitall-Tatum Co., New York, N. Y.

INVENTORIES, PLANT & PERPETUAL
Recording & Statistical Corp., New York, N. Y.

LABORATORIES, TESTING
Electrical Testing Labs., New York, N. Y.

LADDERS, TRUCK MOUNTED
Bay, C. A., Morristown, N. J.
Line Material Co., South Milwaukee, Wis.
Metropolitan Device Corp., Brooklyn, N. Y.

LAMPS, INCANDESCENT
General Electric Co., Cleveland, O.
Hygrade Sylvania Corp., Salem, Mass.
Westinghouse Lamp Co., New York, N. Y.

LAMPS, MERCURY VAPOR
General Elec. Vapor Lamp Co., Hoboken, N. J.

LAMP REPLACERS
G. C. A. Mfg. Co., Pittsfield, Mass.

LIGHTING EQUIPMENT, INDUSTRIAL
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., New York, N. Y.
Holophane Co., New York, N. Y.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

LIGHTING EQUIPMENT, STREET
General Electric Co., Schenectady, N. Y.
Gillinder Bros., Inc., Port Jervis, N. Y.
Graybar Electric Co., New York, N. Y.
Holophane Co., New York, N. Y.
Hubbard & Co., Pittsburgh, Pa.
Line Material Co., South Milwaukee, Wis.

LIGHTNING ARRESTERS
General Electric Co., Schenectady, N. Y.
Line Material Co., South Milwaukee, Wis.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

LINE MATERIAL
Graybar Electric Co., New York, N. Y.
Hubbard & Co., Pittsburgh, Pa.
Kearney Corp., James R., St. Louis, Mo.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Ohio Brass Co., Mansfield, O.

LINE SPLICE, AUTOMATIC
Electroline Co., Chicago, Ill.

LUGS, SOLDERING
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Wolverine Tube Co., Detroit, Mich.

LUGS, SOLDERLESS
Palmer Elec. & Mfg. Co., Waltham, Mass.
H. B. Sherman Mfg. Co., Battle Creek, Mich.

MACHINES, INSULATING
American Ins. Machy. Co., Philadelphia, Pa.

METER BOXES, OUTDOOR
Corcoran-Brown Lamp Co. Cincinnati, O.
Metropolitan Device Corp., Brooklyn, N. Y.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Walker Electrical Co., Atlanta, Ga.

METER BUSHING
Utilities Products Co., Minneapolis, Minn.

METER TESTERS
General Electric Co., Schenectady, N. Y.
Weston Elec'l Instrument Corp., Newark, N. J.

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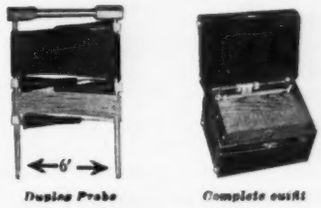
For measuring the resistance of earth electrodes. (Ground tests)



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MEN OF THE INDUSTRY

E. B. Meyer Nominated for A.I.E.E. Presidency

Edward B. Meyer, vice-president United Engineers & Constructors, Inc., Newark, N. J., has been nominated for the presidency of the American Institute of Electrical Engineers for the 1935-36 term. A graduate of Pratt Institute, Brooklyn, N. Y., Mr. Meyer entered the employ of the Public Service Corporation of New Jersey as an engineering assistant in 1903, and remained continuously with that organization and its subsidiary companies until 1922. During this period he became, in 1906, field engineer in charge of the underground conduit and cable system; in 1909, assistant engineer on special engineering reports, estimates and construction work; in 1912, assistant to the chief engineer, and in 1919, assistant chief engineer.

E. B. Meyer

With the formation of the Public Service Production Company in 1922 he was appointed its chief engineer. In 1929 Mr. Meyer was made a vice-president of the Public Service Production Company, and in 1930, on the occasion of the merger of that company with United Engineers & Constructors, Inc., he was appointed a vice-president of the latter corporation in the capacity of executive and engineering head of the Newark office.

In addition to having been a director of the institute, 1928-31, and later a vice-president, 1932-34. Mr. Meyer has served on many of the institute's committees. His other technical activities have included active participation in the affairs of the American Standards Association, the former National Electric Light Association, the New York Electrical Society, Inc., of which he is now first vice-president, the American Society of Mechanical Engineers and the American Transit Association. His numerous contributions to the technical press have dealt chiefly with electric transmission and distribution problems.

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▶ J. Norman Pierce, president of the Pierce Electric Company, electrical contractors, has been elected president of the Electric Association of Chicago.

▶ C. E. Davies, since 1931 executive secretary of the American Society of Mechanical Engineers, has been appointed national secretary of the society. He succeeds Dr. Calvin W. Rice, whose death last October terminated 27 years of active service as national secretary.

▶ Fred Taylor, general superintendent for the Western Public Service Company at Scottsbluff, Neb., has been transferred to Rockford, Ill., where he takes a similar position with the Illinois Electric Company. W. P. Venable, plant superintendent at Scottsbluff, has succeeded Mr. Taylor as general superintendent.

▶ Henry M. Brundage, vice-president of the Consolidated Gas Company of New York, has retired after completing 40 years of continuous service. Mr. Brundage has a wide acquaintanceship in utility circles, having been identified with national and state utility organizations for many years. He served as treasurer of the American Gas Association from 1920 to 1926 and as president of the Empire State Gas and Electric Association in 1926 and 1927. One of his major contributions was his work on a uniform classification of accounts for the utility industry.

▶ Col. Edwy L. Taylor has been elected chairman of the Connecticut Public Utilities Commission, to succeed the late Richard T. Higgins. Mr. Taylor, who has been a member of the commission since 1931, is an engineer of long experience. A native of Albany, N. Y., and a graduate of Yale University, he served as assistant instructor in the Sheffield Scientific School at Yale and subsequently as assistant professor in the University of Kansas. From 1906 to 1930 Colonel Taylor was in the employ of the New York, New Haven & Hartford Railroad. Alvan W. Hyde of Hartford has been appointed to the commission. He is a member of the law firm of Gross, Hyde & Williams.

H. C. Hopson Resigns from Associated Gas Company

Howard C. Hopson, vice-president and director of companies of the Associated Gas & Electric System, has resigned as director and vice-president of the Associated Gas & Electric Company, the controlling unit in the system. He continues as vice-president and director of Associated Gas & Electric Corporation and other units.

Mr. Hopson has been identified with the Associated system for many years and has been an outstanding utility operator and the directing mind of the system for the past ten years. After completing work in economics and law at the University of Wisconsin and George Washington University, where he received an M.A. degree, he was admitted to the bar in the District of Columbia and was later employed by the Interstate Commerce Commission. In 1908 he went to Albany with the New York Public Service Commission and in 1915 he established the firm of H. C. Hopson & Company, public utility consultants in New York City.

H. C. Hopson

It was in 1922 that he became vice-president and treasurer of the Associated Gas & Electric Company.

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▶ H. W. Brooks, consulting engineer, who has been serving as assistant director of the electric rate survey under way by the Federal Power Commission, has resigned as of December 1 to return to consulting practice. Mr. Brooks was formerly a consultant for the governors of Ohio, Pennsylvania and New York in connection with the state institutions and has long been active in consulting work for industrial and utility concerns. For a long period he specialized in fuel research for the U. S. Bureau of Mines.

PRODUCT INDEX

METERS, DEMAND
Duncan Electric Co., Lafayette, Ind.
General Electric Co., Schenectady, N. Y.
Lincoln Meter Co., Springfield, Ill.
Retlau Electric Appliance Co., New York, N. Y.
Sangamo Electric Co., Springfield, Ill.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

METERS, FOOT-CANDLE
Sight Light Corp., New York, N. Y.
Weston Elec'l Instrument Corp., Newark, N. J.

METERS, PREPAYMENT
Landis & Gyr, Inc., New York, N. Y.
Sangamo Electric Co., Springfield, Ill.

METERS, WATTHOUR
Duncan Electric Co., Lafayette, Ind.
General Electric Co., Schenectady, N. Y.
Sangamo Electric Co., Springfield, Ill.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

MICA
Macallen Co., Boston, Mass.

MOTORS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Graybar Electric Co., New York, N. Y.
Lincoln Electric Co., Cleveland, O.
Wagner Electric Corp., St. Louis, Mo.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

OIL, INSULATING
Gulf Refining Co., Pittsburgh, Pa.
Socony-Vacuum Corp., New York, N. Y.
Texas Company, New York, N. Y.

OIL AND GREASE, LUBRCATING
Gulf Refining Co., Pittsburgh, Pa.
Socony-Vacuum Corp., New York, N. Y.
Texas Company, New York, N. Y.

PAINTS
Sherwin-Williams Co., Cleveland, Ohio

PANEL BOARDS
General Electric Co., Schenectady, N. Y.

PHOTOELECTRIC DEVICES
Cutler-Hammer, Inc., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.
Weston Elec'l Instrument Corp., Newark, N. J.

PLIERS
Crescent Tool Co., Jamestown, N. Y.
Klein & Sons, Mathias, Chicago, Ill.

POLE LINE HARDWARE
Graybar Electric Co., New York, N. Y.
Hubbard & Co., Pittsburgh, Pa.
Line Material Co., South Milwaukee, Wis.
Locke Insulator Corp., Baltimore, Md.
Ohio Brass Co., Mansfield, Ohio

POLES CEDAR
Bell Lumber & Pole Co., Minneapolis, Minn.
Graybar Electric Co., New York, N. Y.
MacGillis & Gibbs Co., Milwaukee, Wis.
National Pole & Treating Co., Minneapolis
Naugle Pole & Tie Co., Chicago, Ill.
Page & Hill Co., Minneapolis, Minn.
Valentine-Clark Co., St. Paul, Minn.
Weyerhaeuser Sales Co., St. Paul, Minn.

POLES, PINE
Graybar Electric Co., New York, N. Y.

POLES, STEEL
American Bridge Co., Pittsburgh, Pa.
Blaw-Knox Co., Pittsburgh, Pa.

POTHEADS
G & W Elec. Specialty Co., Chicago, Ill.
Line Material Co., South Milwaukee, Wis.

POWER FACTOR CORRECTIVE DEVICES
Products Protection Corp., New Haven, Conn.

PREHEATERS, AIR
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N. Y.
Superheater Co., New York, N. Y.

PROTECTIVE DEVICES
Salisbury & Co., W. H., Chicago, Ill.

PULVERIZED FUEL EQUIPMENT
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N. Y.

PUMPS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

PYROMETERS
Hoskins Mfg. Co., Detroit, Mich.

RACKS, SECONDARY
Hubbard & Co., Pittsburgh, Pa.

RADIO PARTS, PHENOL & VULCANIZED FIBRE
Continental-Diamond Fibre Co., Bridgeport, Pa.

RAIL BONDS
American Steel & Wire Co., Chicago, Ill.
Ohio Brass Co., Mansfield, O.

RAKES, RACK
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.

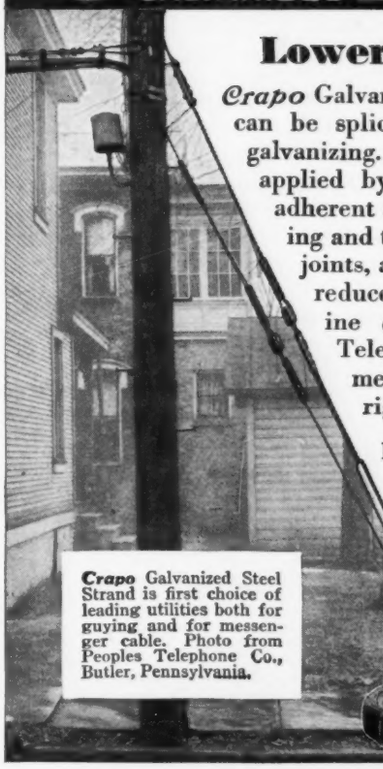
RANGES
Edison G. E. Appliance Co., Chicago, Ill.
General Electric Co., Cleveland, O.
Standard Electric Stove Co., Toledo, O.
Walker-Pratt Mfg. Co., Boston, Mass.
Westinghouse E. & M. Co., Mansfield, O.

RATE STUDY TABULATIONS
Recording & Statistical Corp., New York, N. Y.

REACTORS
American Transformer Co., Newark, N. J.
General Electric Co., Schenectady, N. Y.
Metropolitan Device Corp., Brooklyn, N. Y.

Crapo
GALVANIZED PRODUCTS

INDIANA STEEL & WIRE CO. Crapo Galvanizing MUNCIE, IND.



Crapo Galvanized Steel Strand is first choice of leading utilities both for guying and for messenger cable. Photo from Peoples Telephone Co., Butler, Pennsylvania.

Lower Maintenance Costs

Crapo Galvanized Telephone Wire and Steel Strand can be spliced and served without injury to the galvanizing. The heavy, uniform, *pure zinc* coating, applied by the *Crapo* Patented Process, is so adherent and so ductile that it defies sharp bending and twisting. This insures corrosion-resisting joints, adds to the life of the wire and actually reduces maintenance costs .... Specify genuine *Crapo* Galvanized Steel Strand and Telephone Wire for all new and replacement work! They more than meet the most rigid specifications. ....

Indiana Steel & Wire Company
Muncie, - Indiana

Telephone Wire • • Steel Strand

ACME PARVOLT CAPACITORS OIL IMPREGNATED
for Capacitor Motors
. . . the result of many years' experience in power factor correction in the Capacitor Motor Field. Let us help with your Capacitor problems.
ALSO: MAGNET WIRE—COILS VARNISHED INSULATIONS
THE ACME WIRE CO.
New Haven, Conn.
BRANCH OFFICES IN PRINCIPAL CITIES

"COPPERWELD"
WIRE, STRAND, GROUND RODS
Nada BRONZE
WIRE and CABLE
Bare and Weatherproof
COPPERWELD STEEL COMPANY
GLASSPORT, PA.

Uniformly high in quality, meeting the most rigid specifications.
COPPER WIRE and CABLE ... Bare and Weatherproof

THE Wej-Lock ANCHOR

No. 84
140 sq. in.

This 8" 4 way Wej-Lock has exceptional holding power. Tests have shown that its 140 square inches of area will hold 35,000 pounds without damage to the anchor, or 250 pounds, 1/8 of a ton, per square inch of area. This unusual strength is notable in all Wej-Lock types because they are balanced. The strain is equalized.

For heavy duty specify Wej-Lock

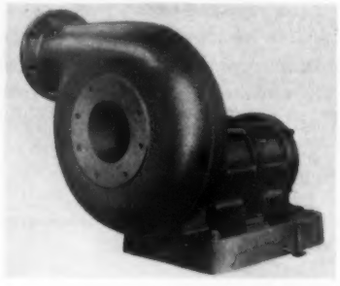
Chance LINE EQUIPMENT
Serving Public Utilities Since 1907

Chance Company
FACTORY & GENERAL OFFICES, CENTRALIA, MO.

NEW EQUIPMENT

Geared-Head Turbo-Blowers

A compact centrifugal compressor (turbo-blower) making use of a gearmotor has been announced by Allis-Chalmers Manufacturing Company, Milwaukee,



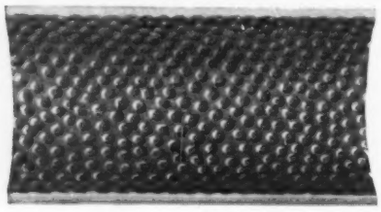
Allis-Chalmers

Wis. The blower runs at higher than motor speeds, thus reducing dimensions and improving performance. Pressures from 0.75 lb. gage to 3.0 lb. gage are developed, the volumetric capacities corresponding to motor outputs from 3 to 30 hp. The units have application for foundry cupola blowing, oil- and gas-fired furnace, pneumatic conveying, agitation and aeration and for similar moderately low-pressure air or gas supply services.

•

Conduit Provides Ball-Bearing Surface

New type conduit that provides a ball-bearing surface which greatly reduces wire-pulling friction has been announced by Steel & Tubes, Inc., Cleveland, Ohio. The inside of this new conduit, which is called "Electrunite" steel tubes, is processed, prior to forming and welding, so that the entire surface is covered with small, round, raised knobs which produce what the manufacturer refers to as a



Steel & Tubes, Inc.

ball-bearing surface. It is claimed by the manufacturer that this type of contact surface reduces the surface friction 30 per cent and, in addition, requires less time and cuts down jamming in the pulling of cable. No threading is required in the installation of this conduit and it will cut and bend more easily than the old style.

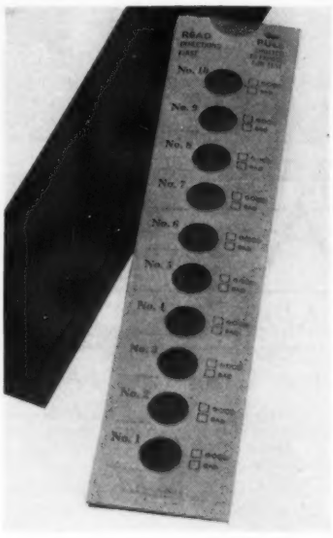
•

Service and Range Panels

Additions to its 550,000 line of main service and range panels has been made by the Bull Dog Electric Products Company, Detroit, Mich. These consist of combinations for 60-amp. "SAFtoFuse" cartridge fusible switches with 2, 4, 6, 8 and 10-plug fusible circuits for lighting or other loads, designed for the meter-switch-fuse new wiring sequence.

•

Sensitive Paper Indicates Lighting Intensity

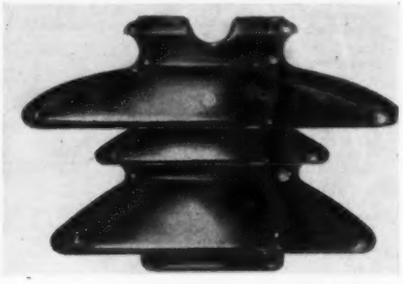


Westinghouse

A "Light-O-Graph," which consists of a strip of appropriately sensitive photographic paper inclosed in a light-proof envelope, has been developed by the Westinghouse Electric & Manufacturing Company. The envelope is colored to a very definite shade and has ten round apertures through which the sensitive paper is exposed to the light. The sensitive paper, before exposed, is of a light yellow color. As it is exposed to light it turns darker. In 2½ minutes, under the proper lighting intensity, the sensitive paper will turn a shade as dark as or darker than the color printed on the protecting envelope. If, however, in 2½ minutes the sensitive paper is lighter than the protecting envelope, then the lighting is not of sufficient intensity.

Uni-Part Insulators

To meet the demand for a one-piece pin-type insulator equivalent in size and electrical values of comparable insulators normally used on transmission lines of



Ohio Brass

from 22 to 46 kv. the Ohio Brass Company, Mansfield, Ohio, has recently announced a line of three O-B "Uni-part" insulators. These insulators, says the manufacturer, are exceptionally rugged and are especially adapted for use on line locations where insulator replacements are heavy because of breakage due to shooting, stone throwing or from other mechanical impacts.

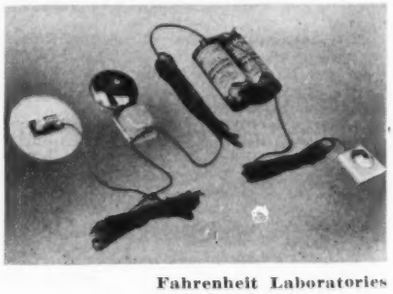
•

MILE-RANGE SEARCHLIGHT which can be used as either a five-cell searchlight or a long-mile-range ten-cell searchlight has been announced by the Bond Electric Corporation, Jersey City, N. J. In the spare bulb carrier there is a 6.2-volt bulb which must be used with the five-cell searchlight and an extra 11.8-volt, ten-cell bulb.

•

Thermotact Fire Alarm

"Thermotact," a new product of Fahrenheit Laboratories, New York, consists of a small fuse that will melt and make



Fahrenheit Laboratories

electrical contact at 150 deg. F. It is connected to the doorbell wiring. In case of fire the Thermotact fire alarm detects fire before it gains headway, it is claimed.

6 Reasons Why

the new M-20 demand register will save you money . . . . .

Look to the M-20 for Accuracy and Service

May we send you complete information? General Electric Company, Dept. 6C-201, Schenectady, New York.

1 More reliable timing through the use of an improved type of Telechron motor.

2 Your meter man can obtain an over-all accuracy check in a minute. Unique checking device, a part of the register design, saves time and labor.

3 Testing is made easier and time is saved by a new interval indicator and clutch. The indicator shows at a glance the timing of the interval. The clutch permits setting to zero without waiting for the device to complete a cycle, and makes possible the quick over-all accuracy check.

4 Simple adjustments make servicing easy and assure the highest accuracy. They are an essential part of good design.

5 Built to last. Parts are of corrosion-resistant materials; all bearings are permanently located; plates are rigidly spaced and locked.

6 Maximum protection against abnormal conditions is provided by the "follow-up" type of reset mechanism—inherently reliable.

410-39

GENERAL ELECTRIC

PERFECTION OF DETAIL

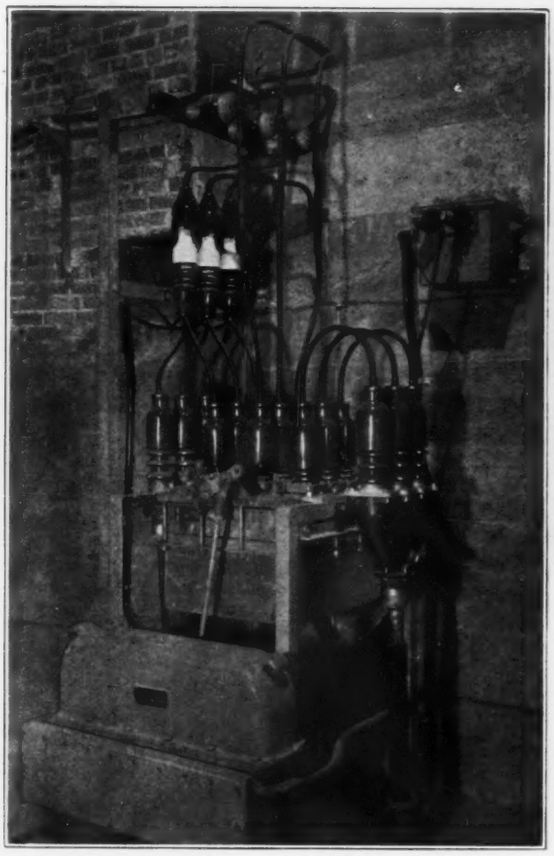
G-E DISTRIBUTION TRANSFORMERS

Insist ON "PERFECTION OF DETAI

General Electric distribution transformers are the crystallized concentrate of forty-eight years of transformer engineering. They are built for those who appreciate the vital importance of the transformer in secondary distribution, and who therefore specify the best.

GENERAL ELECTRIC

G&W CABLE TERMINAL DEVICES
HELP PROVIDE CONTINUITY OF SERVICE ON A SOUTHWESTERN UTILITY SYSTEM

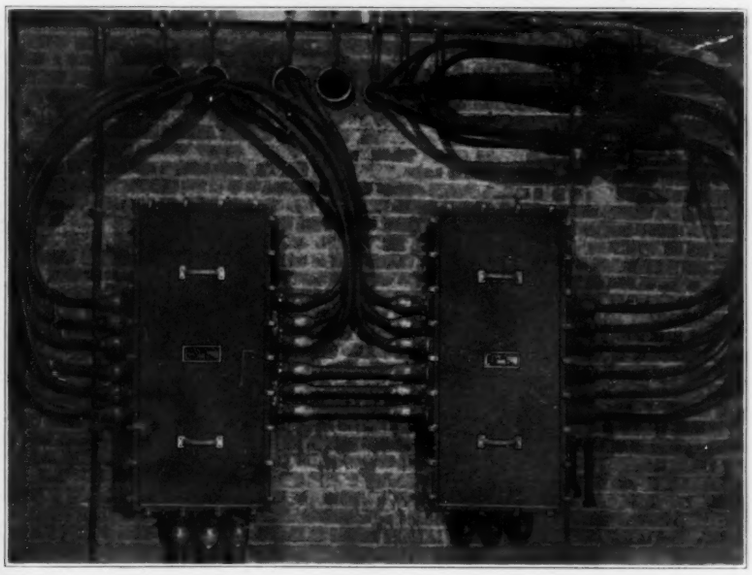


G & W Type "DT" Double Throw Oil Switch with automatic operating mechanism.

On failure of the preferred circuit voltage the switch automatically throws over to the emergency circuit in 7 cycles.

After normal voltage has been restored on preferred circuit for 2½ minutes, the switch is thrown back to preferred side.

The switch can be by-passed by means of the disconnecting potheads.



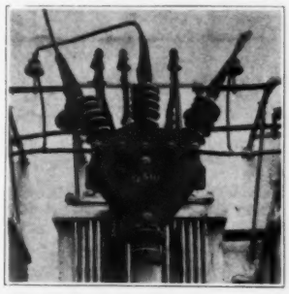
G & W Type "A" Secondary Boxes. The main feed cables are brought in through the bottom and connected to bus bars by means of copper links.

Each box shown provides for a maximum of six branch circuits, 3 conductor, 500,000 c.m. maximum. Blanked ways provide for future expansion. Copper link fuses or solid copper links can be used interchangeably on branches.

Cable heads are interchangeable for single conductor cables as shown or for multiple conductor cables and are fitted with either wiping sleeves or stuffing box entrances.

Light weight sheet aluminum lids fastened by means of forged "C" Clamps are easily handled.

This same utility company regularly uses G & W POTHEADS for terminating cables.



G & W Type "T" Capnut Pothead subjected to cooling tower spray for several years.

G & W Type "VO" Inverted Pothead solved a problem of transformer connection.

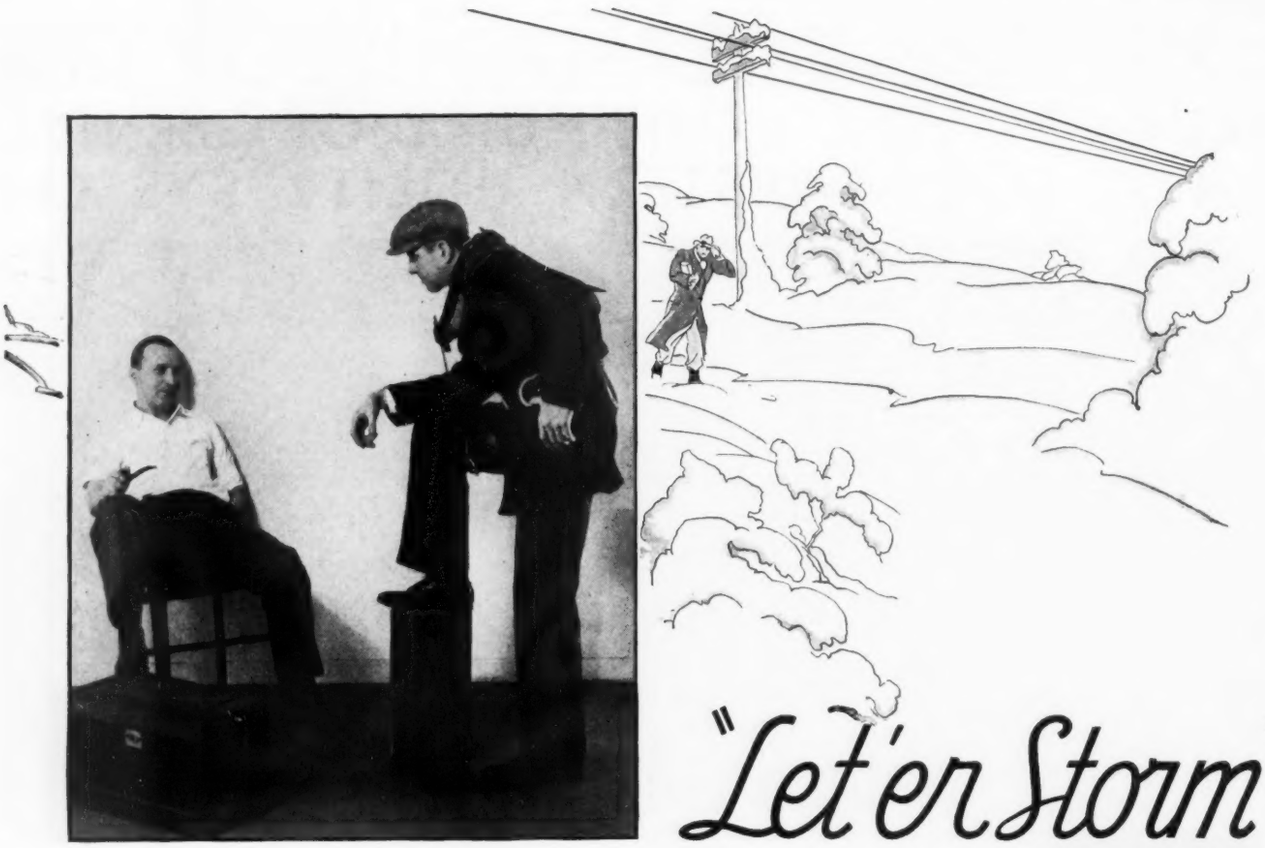
Cable Terminal Device Engineers & Manufacturers Since 1905

G&W ELECTRIC SPECIALTY CO.

7780 DANTE AVE., CHICAGO, ILL.

Potheads + Boxes + Combination Oil and Air Break Switches

MADE IN CANADA BY POWERLITE DEVICES, LTD., TORONTO



"Let'er Storm"

"WEATHER DOESN'T BOTHER RELIANCE U·R·C· WEATHERPROOF WIRES AND CABLES"

YES—let'er storm. Any weather and any temperature is a made to order condition of service for **Reliance U. R. C. Weatherproof Wires and Cables.** Ask for samples now—see for yourself why these wires and cables make replacement due to exposure a thing of the past. "Reliance" Wires and Cables fully conform to U. R. C. specifications. Complete saturation with high melting point compound insures long life despite the ravages of exposure and overloading. Low temperature pliability is provided to meet any bend test or operating requirements. The copper is "right" and braids are of best quality. Processes and equipment are not "new" to us. Stocks and manufacturing facilities insure of "Service" comparable to the quality of the product.

[Our specification folder will be mailed to you upon request.]

1831 — MORE THAN 100 YEARS OF PROGRESS IN WIRE MAKING — 1934

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago
94 Grove Street, Worcester

SUBSIDIARY OF UNITED STATES STEEL CORPORATION
AND ALL PRINCIPAL CITIES

Empire State Building, New York
First National Bank Building, Baltimore

Pacific Coast Distributors: Columbia Steel Company, Russ Bldg., San Francisco

Export Distributors: United States Steel Products Company, New York

FOR EVERY VITAL SOCKET . . . HYGRADE OFFERS GOOD LIGHT

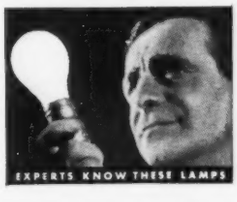
STREET SERIES LAMPS	CUT-OUT LAMPS
INSIDE WHITE BOWL LAMPS	VACUUM CLEANER LAMPS
ROUND BULB LAMPS	ARC-RESISTING LAMPS
STANDARD INSIDE FROSTED LAMPS	COUNTRY HOME LIGHTING LAMPS
MILL TYPE LAMPS	TRAIN LIGHTING LAMPS
ROUGH SERVICE LAMPS	DAYLIGHT LAMPS
FLOODLIGHT LAMPS	TRAFFIC SIGNAL LAMPS
VIBRATUNED MILL TYPE LAMPS	LOCOMOTIVE HEADLIGHT LAMPS
SPOTLIGHT LAMPS	COLORED LAMPS
LARGE WATTAGE LAMPS	SEWING MACHINE LAMPS
DECORATIVE LAMPS	STREET RAILWAY LAMPS
SIGN LAMPS	

● For more than 30 years, this company has served the cause of Good Lighting by manufacturing and promoting only full-standard, high quality lamps.

The accompanying list shows the extensive range of types that carry the Hygrade name today.

NRA

HYGRADE LAMP BULBS



A PRODUCT OF

HYGRADE SYLVANIA CORPORATION

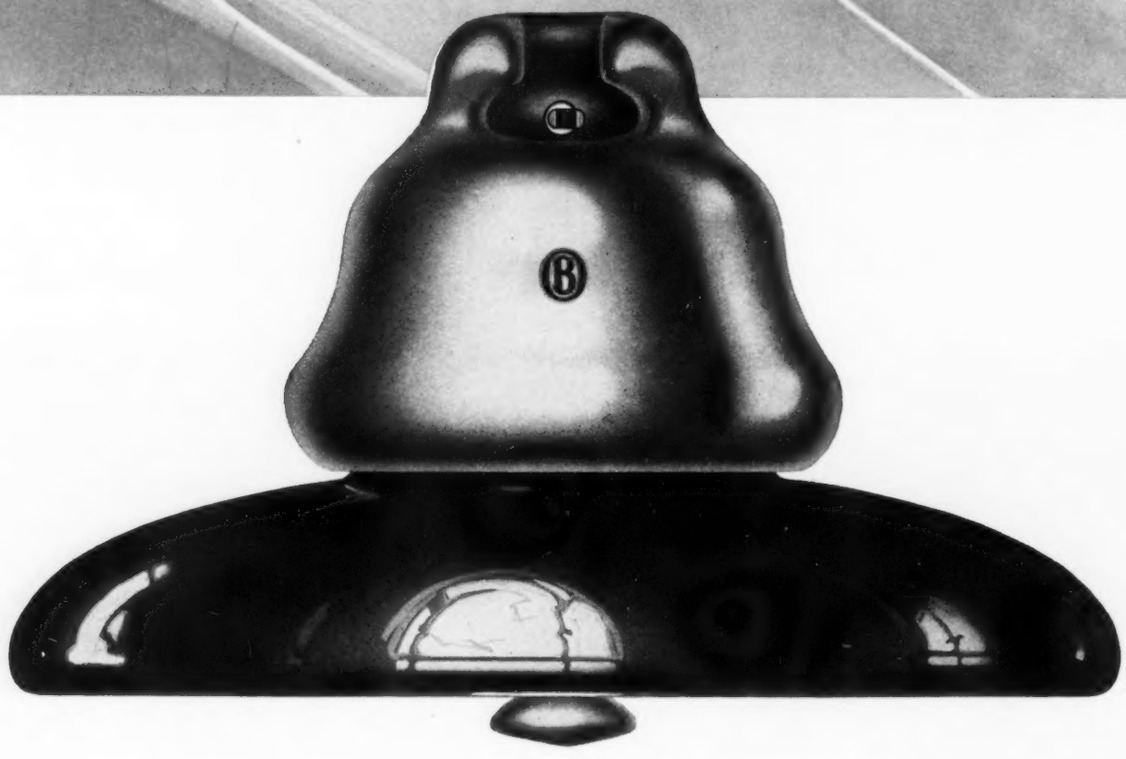
Salem, Mass.

MANUFACTURERS OF HYGRADE LAMPS, SYLVANIA RADIO TUBES, ELECTRONIC DEVICES

MAKERS OF FINE INCANDESCENT LAMPS FOR MORE THAN 30 YEARS

©1934, H.S.C

If Autos had



There is an O-B unit for every normal application found in the transmission and distribution of electricity.

NRA CODE

3 Places for Steering Wheels- and INSULATORS had 100 Strengths- BOTH WOULD COST MORE

● If many varieties of engines were offered in a car by one automobile manufacturer—if three autos of the same make were offered with the choice of having the steering column and wheel either in the center, to the right, or to the left, the manufacturing process of each type would be more costly. The purchaser would pay more. But with engines and car-assembly standardized, the dollar spent today for an automobile buys more service, comfort, economy, and utility than it ever did before.

Insulators are much the same. When strength ratings of suspension insulators are approached with the understanding of the rewards of rational standardization, the manufacturer of insulators can offer more for the user's money. In the case of O-B suspension insulators, the reduction of strength classifications to a reasonable number is one factor which enables O-B to offer insulators improved as to mechanical strength. What is more, the standardization of strengths permits O-B to offer the proper balance between strength and life in the insulator and to sell these improved units at no increase in price above its standard insulator of the past.

This line of improved O-B suspension insulators is as complete as it can economically be made. There is a unit for every normal application found in the transmission and distribution of electricity. Disc diameters range from six to twelve inches; and strengths from 10 to 36,000 lbs.

Users of these improved O-B suspension insulators can expect and will receive the same exceptionally long service life which favorably marks all O-B insulators.

1714H

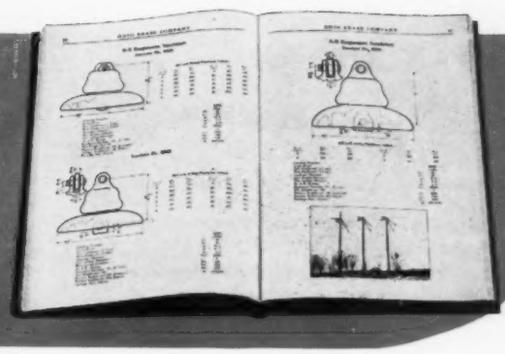
OHIO BRASS COMPANY

Mansfield, Ohio, U.S.A.

Canadian Ohio Brass Co. Limited, Niagara Falls, Ontario, Canada

New York · Philadelphia · Boston · Pittsburgh · Chicago · Cleveland
Atlanta · Dallas · Los Angeles · San Francisco · Seattle

Pages 48 to 65 of your new O-B Catalog No. 21 give complete data as to the characteristics and values of the improved O-B suspension insulators.



Only ONE

BUT--SOCKETS FOR

when you use UNIVERSAL DETACHABLE METERING

THE standardized Westinghouse type CS Universal Detachable Meter. Its element is mounted in the same Type S armor-mounting parts used in universal detachable metering. It assures all of the money-saving advantages of detachable metering and also has many distinctive construction features which assure not only initial but also permanent straight-line accuracy up to 300 per cent rating. It requires only three ratings for all self-contained loads up to 150 amperes.

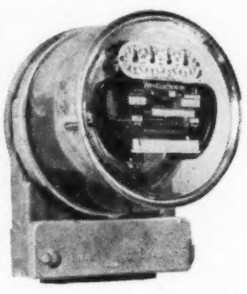
Some of its important features are: No mechanical adjustments; only two electrical adjustments; accurately machined, gold-plated gears; jeweled bearings; and one-piece electromagnet laminations.

UNIVERSAL Detachable Metering means that you use only *one type of housing* for every meter on your system—that every meter can be quickly and readily interchanged with any other.

Nothing is overlooked to make it completely practical, and to permit its adoption at minimum cost.

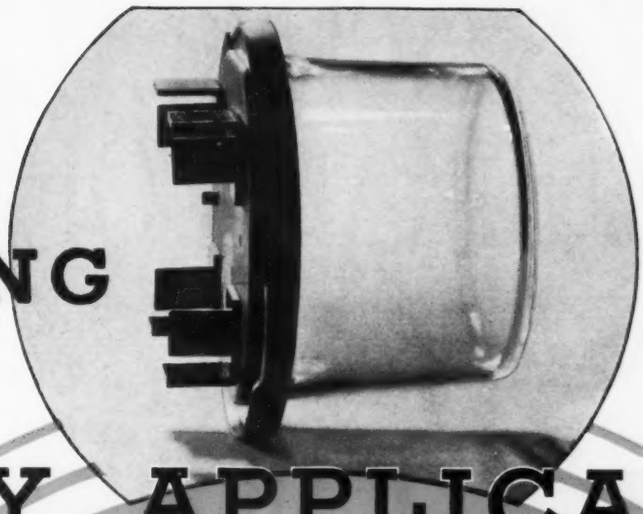
For example, no matter where you want to mount a meter, there is a socket especially suited for the application. Shown on the opposite page are a few of those available. In the complete line, you will find the particular mounting arrangement to fit any application.

Detachable metering is suitable not only for Westinghouse meters, but also for all American makes of meters built since 1914, in all capacities up to and including 50 amperes, 2- or 3-wire.



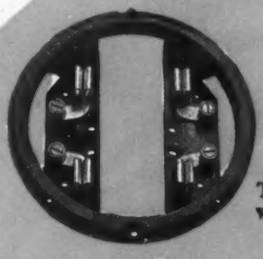
The CA meter consists of an OC element on the new type A base.

HOUSING

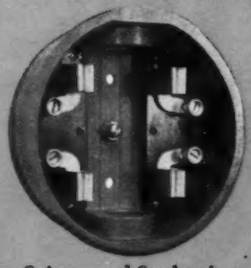


This single Enclosure, made up of Type S armor-mounting parts will house all American makes of meters built since 1914, in capacities up to and including 50 amperes, 2- or 3-wire service.

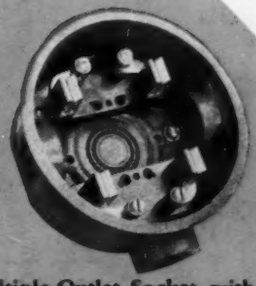
EVERY APPLICATION



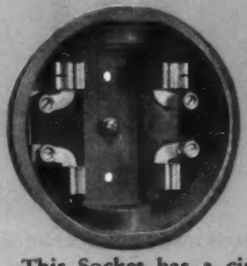
Flush-Mounting Armored Socket designed for trough installations.



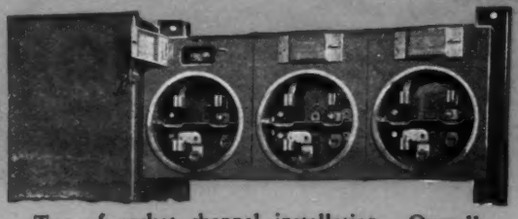
The type S Armored Socket is most universally used in detachable metering.



Multiple Outlet Socket, with knock-outs in back, is suitable for group installations and other requirements, including low-cost range service.

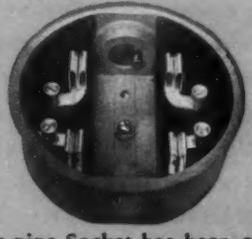


This Socket has a circuit-closing device to prevent service interruption when the meter is removed.



Top of socket channel installation. Overall size for 9 meters—34″ x 36″. End box for fuses.

When a detachable meter is removed, socket is sealed with a weather-proof plate.



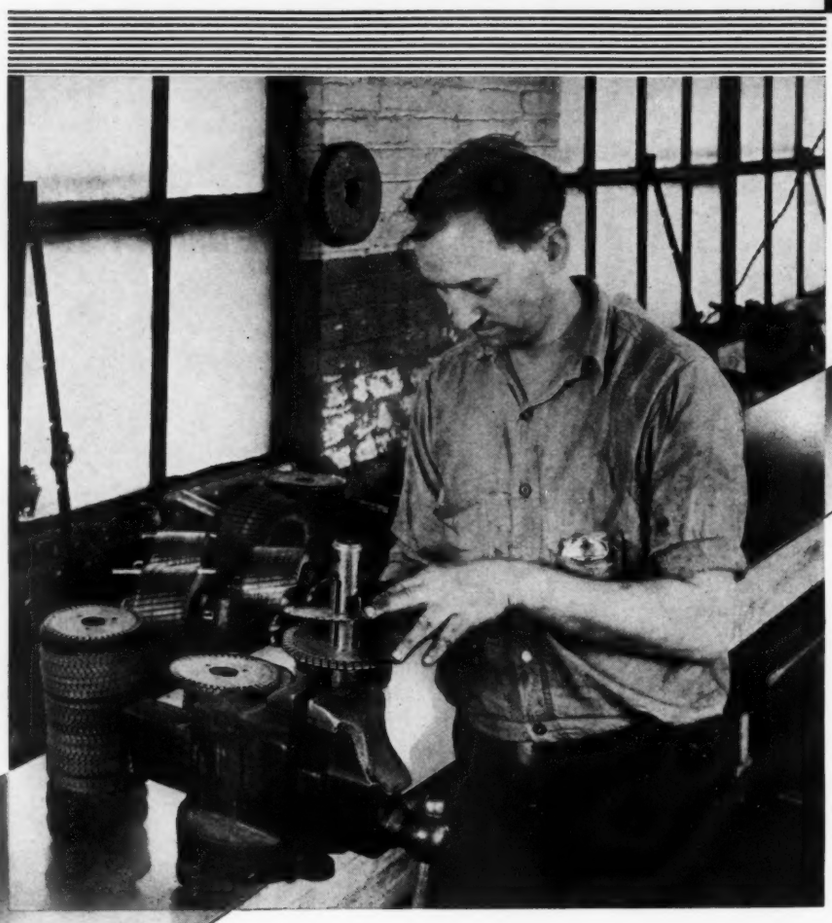
This Double-pipe Socket has been converted into a Single-pipe Socket by means of a sealing-screw plug.

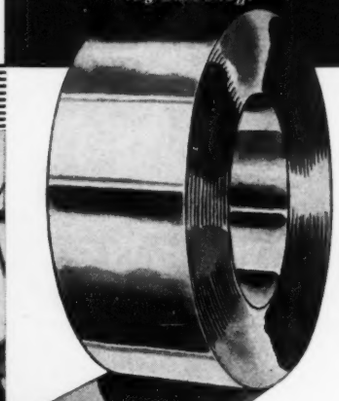
WESTINGHOUSE ELECTRIC

Westinghouse

THEY STACK FLAT WHEN MADE OF

REPUBLIC SIL-CON
PERFECTED ELECTRICAL STEELS...SHEET AND STRIP
Reg. U.S. Pat. Off.





Licensed under patents 1,867,818; 1,932,306 to 1,932,309 inclusive; and other patents applied for.

It's almost unbelievable, but it's true. Laminations made of Republic Sil-con Coiled Strip Electrical Steel lie absolutely flat. A special treatment removes all coil set from the steel and brings about the result for which manufacturers of motors, generators, transformers and radios have been waiting.

Flat stacking means a better product, faster assembly and lower costs. But this is only one of the advantages of Sil-con—Republic's Perfected Electrical Strip Steel. It shows the same performance as the finest sheets of equal grade. It has high permeability and low core loss. It is of uniform temper, size and gauge. It is absolutely free from loose scale. It increases die life and reduces handling costs and scrap loss.

Sil-con Strip is made in five grades—Armature, Electrical, Special Motor, Special Dynamo and Transformer. Try the correct grade in the equipment you manufacture and learn at first hand what Sil-con can do to help you meet or beat competition. Your inquiry will be answered by an electrical consultant who understands your needs.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES YOUNGSTOWN, OHIO

The most talked about development in the Wire and Cable Industry

Laytex After Lastex

Not blushing to use the word "revolutionary," U. S. Rubber Co. last week announced Laytex, a new insulation.

Laytex is made from latex (rubber tree milk) from which proteins, sugars and water solubles are removed. Lengths of wire to be insulated are fed vertically through tanks containing the processed milk. As each immersion a film of milk the wire and dries, a into the tank. Thus the insulation is built tor, the wire is accurat

U. S. Rubber Announces New Flexible Insu

LAYTEX, a ne directly fr tree, is a ber Compa turers, th States Rubber Co. Actually un ment for sev ment signal tal phase As mi guessed, L the use of lat

Laytex

New brother of Lastex, U.S. Rubber's new insulation bulks less, weighs less.

LAYTEX, a new electric ("insulation, outside the cal industry), is an nounced by the United States Rubber Co. Actually un test and develop ment for sev public announc try into the comm As mi guessed, L the use of lat

Laytex Wire Insulation

A NEW insulation known as has been developed by the States Rubber Company N. J. Tests indicate high in flexibility, resistance to co strength and ins therefore perm thinner but superior and electrical character flexible insulation mate ness of the walls reduction in diam from standard rubber-c ductors. For certain tion of 25 per cen diameter and 50 p of the conductor Laytex is derived d the milk of the rub rials which and which insulation, processes. through a s and during takes on a fil almost immediately converted liquid to solid. The liquid before the conductor comes tact with any mechanical de show that 750 per cent, portant margi strength is approache non-flexi cause the lated di a hu

New Dielectric

-Laytex," a new and revolutionary dielectric has just been announced by the United States Rubber Co. A high degree of flexibility, great tensile strength and increased compression, high dielectric strength and insulation resistance and the ability to permit thinner walls which make possible finished conductors lighter in weight and smaller in bulk, are among the claims made for the new product. It is derived directly from latex, the milk of the rubber tree. It is a non-coagulated, non-milled dielectric which has been highly purified. It is deposited from A form upon a conductor by the dip or

Revolutionary Flexible Insulation

traordinary improvement in dielectric is predicted by the Rubber Products, Inc., of Passaic, N. J., manufacturers of a new insulation known as "Laytex." As a result of removing certain impurities and processes of removing materials which cause excessive electrical leakage and aging, this superior novel manufacturing method, physical and electrical properties vastly superior to ordinary insulation are attributed to Laytex. A few of the important claims made by the manufacturers are:

Greatest flexibility—insulation will stretch, making it most flexible of all rubber compounds.

Insulation has tensile strength of more than twice that required by A.S.T.M. specifications.

Finished conductor will be smaller and lighter—certain applications showing 25% reduction in outside diameter and 50% in weight.

U. S. Rubber Announces

Laytex, a new dielectric, is announced by the United States Rubber Company, Wire Division. The dielectric is said to possess properties superior to those of ordinary flexible insulations. Laytex is more flexible, has greater tensile strength and greater compression resistance than any other flexible insulation. The insulation is made by the manufacturing method, which

Properties of Laytex Insulation

DUCTION on a commercial scale of wires insulated with Laytex, the dielectric for which many unique properties are claimed, was recently announced by the U. S. Rubber Company. Laytex is said to be more flexible, have greater tensile strength, better resistance to compression, higher dielectric strength and insulation resistance, than any other insulation. Laytex permits thinner walls which make possible conductors lighter in weight and smaller in bulk.

Wires covered with this insulation are passed vertically through a series of baths of latex (the protein, sugars and water solubles removed), the liquid solidifying after each dip. This process centers the conductor perfectly and gives a uniform wall thickness. The electrical properties should be unusual. The dielectric strength, K=3.5; how

New Dielectric

-Laytex," a new and revolutionary dielectric has just been announced by the United States Rubber Co. A high degree of flexibility, great tensile strength and increased compression, high dielectric strength and insulation resistance and the ability to permit thinner walls which make possible finished conductors lighter in weight and smaller in bulk, are among the claims made for the new product. It is derived directly from latex, the milk of the rubber tree. It is a non-coagulated, non-milled dielectric which has been highly purified. It is deposited from liquid form upon a conductor by the dip or method. The liquid is solidified on any th or section before that section in- tact with any mechanical sup- lectric strength of 800 volts, ion resistance constant as high as is re-

Laytex Conductor Insulation

insulation has recently been announced by United States Rubber New York City, which is properties, superior own flexible dielectrics, been named Dielectric. ed from latex, the Laytex, the milk superiority in manufacturers strength and flexibility, resistance to compres- insulation in the opinion of the Codes and even- for wire insulation to per- cent reduced as much as 25 percent conductor overall diameters, through Laytex insulation dielectric is deposited upon the process while in liquid form- baths of conductor which ing in a deposited film becomes set, in a 2-in. gauge length percent stretch, of 14 in. characteristics are stated insulation resistance constant, twice as high as the A.S.T.M. grade of rubber compounds pound, a lower specific inductive capac- than was known for flex- ible dielectric ing moisture absorption of waked in water for this wire insulation normal use in cable. ground wire, sets

New Rubber Insulation

A new rubber insulation called Laytex has been put out which the manufacturers, United States Rubber Products, Inc., believe will revolutionize the electrical industry. It is applicable to virtually all industries which use electrical insulation. Advantages claimed are that this product is the most flexible, has the greatest tensile strength and resistance to compression, has the highest dielectric strength and insulation resistance, and permits thinner but superior walls—making possible finished conductors lighter in weight and smaller in bulk.

New Electrical Insulation Announced by U. S. Rubber

Laytex, a new insulation which according to its makers, promises to revolutionize the electrical industry and to play an important part in the progress of more than a score of allied industries, is announced by the United States Rubber Co. This new product possesses properties claimed to be so superior to those of ordinary flexible insulation that in time, the manufacturer believes, all existing codes and specifications on wire insulation will have to be re-written.

Laytex is derived directly from latex, the milk of the rubber tree. Through

From

New Insulation Deve

THE wire division of U announces Laytex, promises to revolutionize in the prog

United States Rubber Company

1790 BROADWAY NEW YORK CITY

OK ON NATURE'S PROVING GROUND

Onized GLASS PRODUCTS

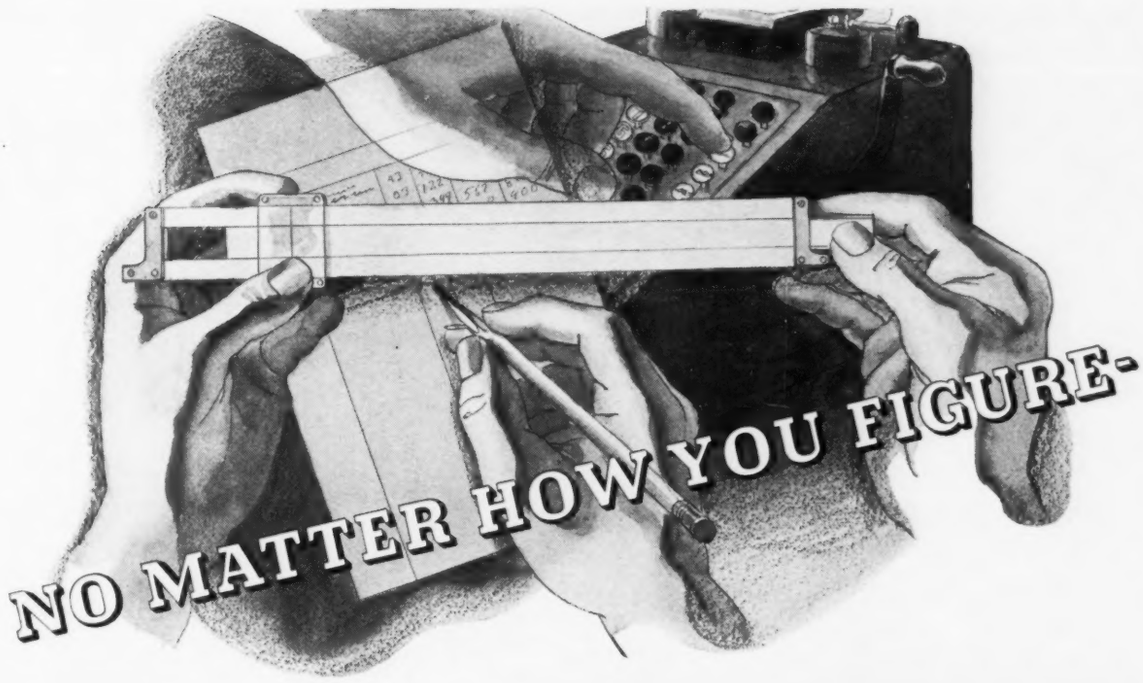
OK FOR LONG LIFE

● There's no proving ground like actual experience. And that's where Hemingray Insulators—made of improved, tougher glass—demonstrate the ability to pass all of nature's tests as they come . . . heat . . . cold . . . storm . . . age. Hemingray Insulators are unaffected by sudden temperature changes. They are homogeneous in character with only one coefficient of expansion. Every feature of Hemingray Glass is designed to give efficient insulator service for primary and secondary power distribution. Ratings up to 10,000 volts. Variety of styles in light green and brown are constantly available. Write about your requirements. Owens-Illinois Glass Company, Hemingray Division, Muncie, Ind.

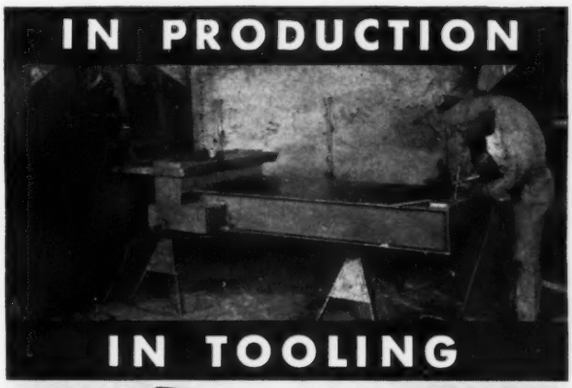
GLASS *offers* **PLUS** *features*

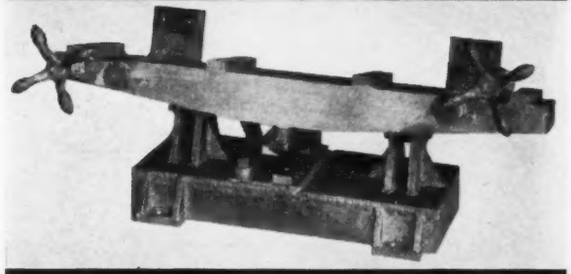
+ No aging or deterioration.
+ Unaffected by sudden temperature changes.
+ Internal strains and stresses removed.
+ Homogeneous in character, only one coefficient of expansion.
+ Sustained high dielectric strength.
+ Clear and flawless for easy inspection.
+ All surfaces are impervious to moisture.
+ This tougher, improved glass withstands rough handling.

HEMINGRAY PIN TYPE GLASS INSULATORS



..YOU SAVE WITH A "SHIELD-ARC" WELDER...





"Shield-Arc" is guaranteed three ways to produce more welding per dollar. Its eleven features, combined in no other welder, make this guarantee possible. For example, the uniformity of its welding current allows use of a higher average current with less splatter and loss of electrode metal. More of the electrode metal goes into the weld. And its high capacity lets you use larger size electrodes with a saving up to 25 per cent of former welding costs.

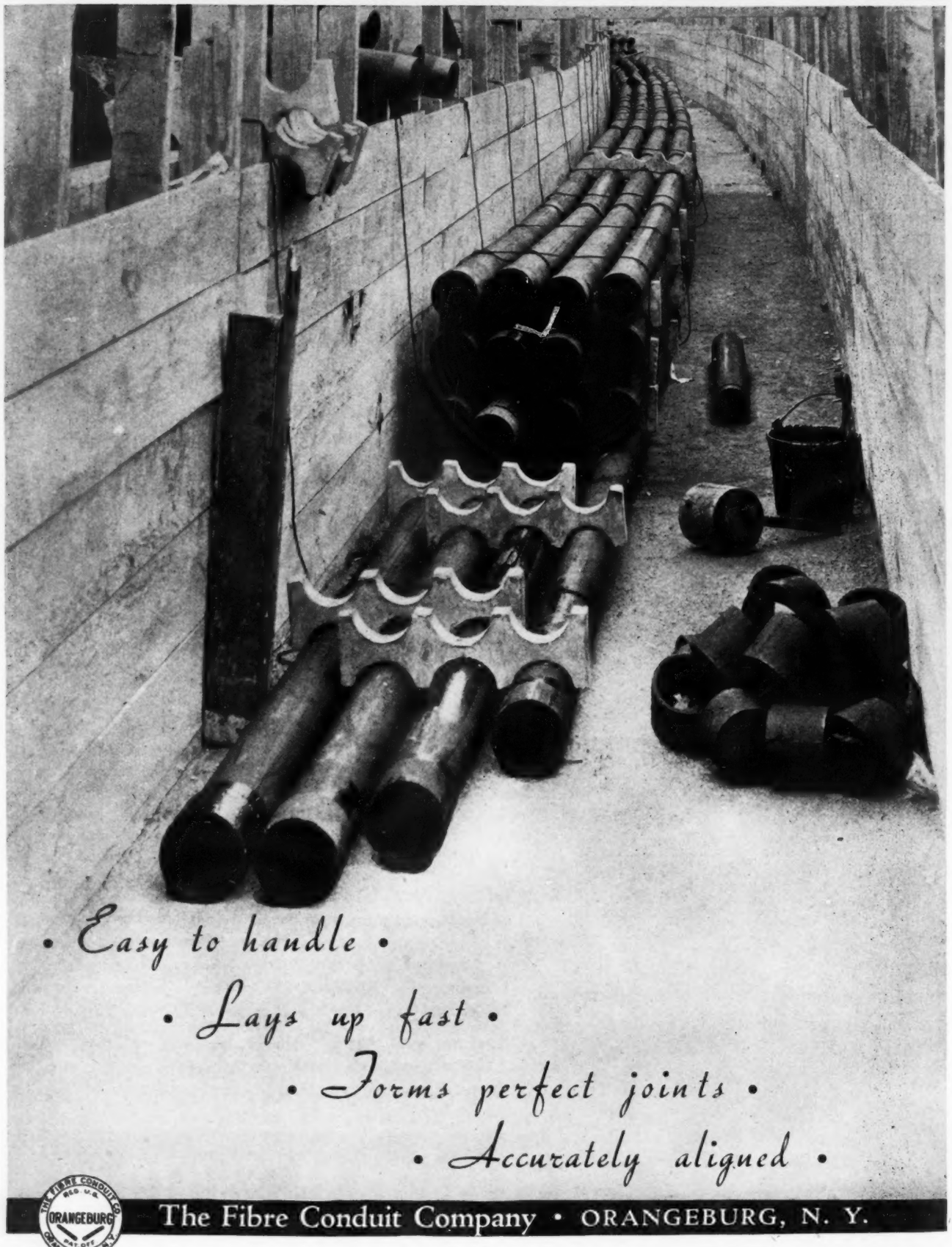
With *"Shield-Arc's"* Lincontrol the operator has control of welding current right in his hands. No extra cables or portable accessories to carry. No time lost going back to the machine to adjust current. Eight other features all contribute to *"Shield-Arc's"* ability to produce more and better welding at lower cost to you.

Find out how much a *"Shield-Arc"* welder will save you. Ask The Lincoln Electric Company, Cleveland, Ohio. Largest Manufacturers of Arc Welding Equipment in the World.

W-92

LINCOLN "SHIELD-ARC" WELDERS

ORANGEBURG FIBRE CONDUIT — *time-tested in 41 years' service*



The Fibre Conduit Company • ORANGEBURG, N. Y.

SALES AGENTS

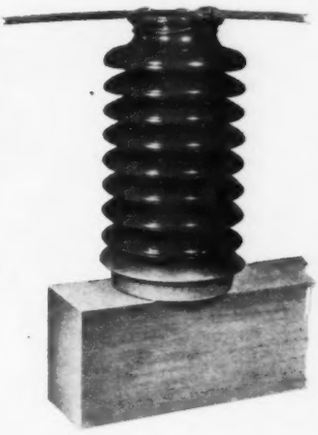
GENERAL ELECTRIC SUPPLY CORP. • GRAYBAR ELECTRIC COMPANY

WATCH FOR THE LINE POST ADVERTISEMENT IN THE NEXT ISSUE OF "ELECTRICAL WORLD"

CURE INSULATOR INTERFERENCE WITH THE

LAPP

LINE POST



- Fog type for dirt conditions
- No radio interference
- No punctures or cracking
- Withstands power arcover
- Resists stones and bullets
- Vacuum process porcelain

THE Line Post solves the problem of radio interference by the design of the porcelain. No superficial treatments, coatings or attachments are required. There is nothing that can change with age.

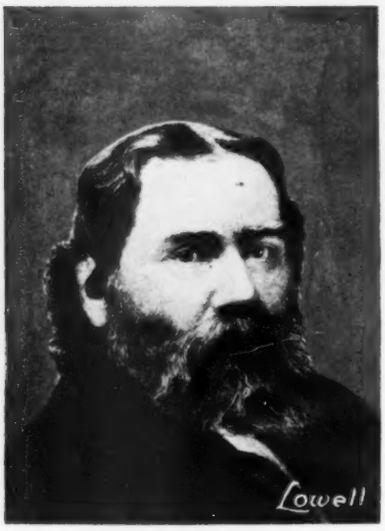
The principle of the design is that of reducing the charging current to the porcelain by making a very low capacitance insulator. All Line Posts are radio-free at the rated neutral voltage with a margin of safety.

And interference elimination is just one of the reasons why you should use Lapp Line Posts. Try them at your first opportunity. Write for Bulletin No. 112 with full catalog information. Samples on request.

THOUGHTFUL PLANNING

The Light and Power Industry is to be commended for its energy in interference elimination. Another channel for improvement is now open—doing away with insulator interference. Complete replacement is impossible but by buying all new insulators of the radio-free type gradual improvement can be made which will in a few years be most constructive.

LAPP INSULATOR CO. INC — LAPP INSULATORS — LE ROY - N.Y. - U.S.A.



EXPERIENCE
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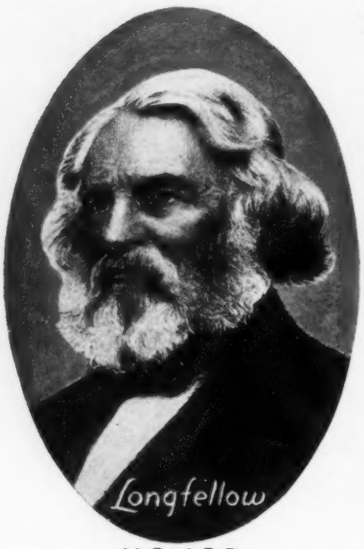

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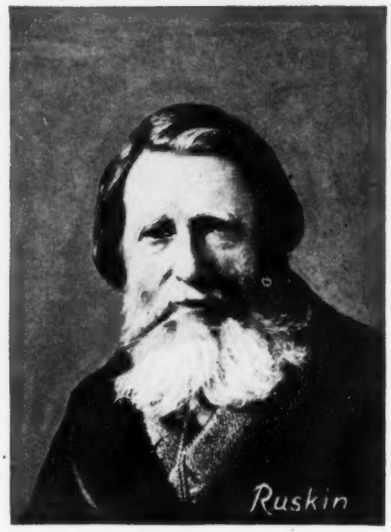

QUALITY
December Issue

FIRMNESS
October Issue

A Friendly Christmas

THE SUPERHEATER COMPANY
THE AIR PREHEATER CORPORATION
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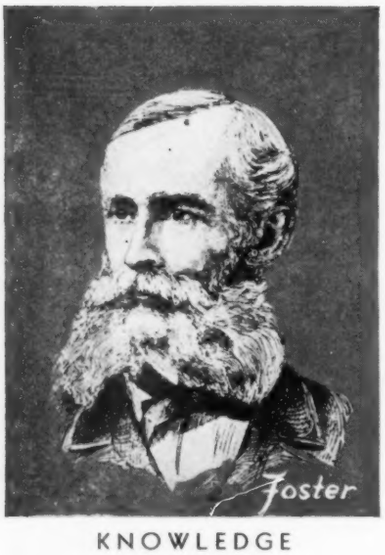
CONFIDENCE
June Issue



KNOWLEDGE
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BUSINESS MORALS
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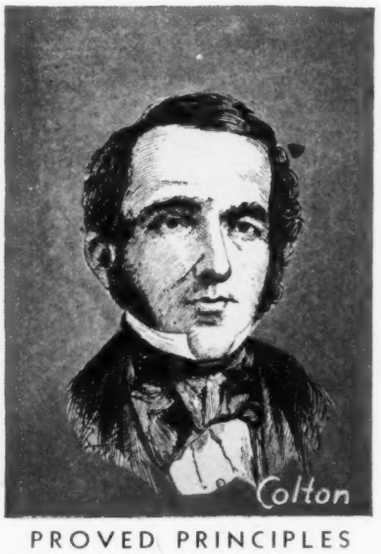

PROVED PRINCIPLES
September Issue

A-933

SUPERHEATERS · AIR PREHEATERS · GRIFFIN HOT BLAST · WATER WALLS · ECONOMIZERS

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RECTIFIERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

REFRIGERATORS
Frigidaire Corp., Dayton, O.
General Electric Co., Cleveland, O.
Kelvinator Corp., Detroit, Mich.
Westinghouse E. & M. Co., Mansfield, O.

REGULATORS, FEEDER VOLTAGE
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

REGULATORS, GENERATOR VOLTAGE
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

REGULATORS, VOLTAGE
American Transformer Co., Newark, N. J.

RELAYS
Dunn, Inc., Struthers, Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.
Weston Elec'l Instrument Corp., Newark, N. J.

RESISTORS
General Electric Co., Schenectady, N. Y.
Weston Elec'l Instrument Corp., Newark, N. J.

RESISTORS, TRANSFORMER
General Electric Co., Schenectady, N. Y.
Schweitzer & Conrad, Inc., Chicago, Ill.

RHEOSTATS
Allen-Bradley Co., Milwaukee, Wis.
Biddle Co., James G., Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.

SEALS, METER
International Seal & Knot Protector Co., N. Y. C.
Metropolitan Device Corp., Brooklyn, N. Y.

SEARCHLIGHTS
Koehler Mfg. Co., Marlboro, Mass.

SECTIONALIZING UNITS, UNDERGROUND
Metropolitan Device Corp., Brooklyn, N. Y.

SHEETS, COPPER, BRASS, BRONZE & NICKEL SILVER
American Brass Co., Waterbury, Conn.

SHEETS, ELECTRICAL
American Sheet & Tin Plate Co., Pittsburgh
Republic Steel Corp., Youngstown, Ohio

SHEETS, RODS & TUBES—MICA, PHENOL OR VULCANIZED FIBRE
Continental-Diamond Fibre Co., Bridgeport, Pa.
Synthane Corp., Oaks, Pa.

SLEEVE WRENCHES
Crescent Tool Co., Jamestown, N. Y.
Kearney Corp., James R., St. Louis, Mo.
Lowell Wrench Co., Worcester, Mass.

SLEEVES, SPLICING
National Telephone Supply Co., Cleveland, O.
Sherman Mfg. Co., H. B., Battle Creek, Mich.

STAMPINGS, MICA, PHENOL & VULCANIZED FIBRE
Continental-Diamond Fibre Co., Bridgeport, Pa.

STANDARDS, STREET LIGHTING, CONCRETE
American Concrete Corp., Chicago, Ill.

STANDARDS, STREET LIGHTING, CEDAR
Page & Hill Co., Minneapolis, Minn.

STARTERS, MOTOR
Allen-Bradley Co., Milwaukee, Wis.
Cutler-Hammer, Inc., Milwaukee, Wis.
Electric Controller & Mfg. Co. Cleveland, O.
General Electric Co., Schenectady, N. Y.
Ohio Brass Co., Mansfield, Ohio

STATISTICAL SERVICE
Recording & Statistical Corp., New York, N. Y.

STEEL, SHEET & STRIP
American Steel & Wire Co., Chicago, Ill.
Republic Steel Corp., Youngstown, Ohio

STEEL, STRUCTURAL
American Bridge Co., Pittsburgh, Pa.

STOKERS
American Engineering Co., Philadelphia, Pa.
Babcock & Wilcox Co., New York, N. Y.
Combustion Engineering Co., New York, N. Y.

SUB-STATIONS, OUTDOOR
General Electric Co., Schenectady, N. Y.
Line Material Co., South Milwaukee, Wis.
Railway & Industrial Engrg.Co.,Greensburg,Pa.

SUPERHEATERS
Babcock & Wilcox Co., New York, N. Y.
Superheater Co., New York, N. Y.

SURGE ABSORBERS
Ferranti, Inc., New York, N. Y.

SWITCHBOARDS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
I-T-E Circuit Breaker Co., Philadelphia, Pa.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

SWITCH HOUSES
Condit Elec'l Mfg. Corp., Boston, Mass.

SWITCHES, DISCONNECT
G & W Elec. Specialty Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Kearney Corp., James R., St. Louis, Mo.
Line Material Co., South Milwaukee, Wis.
Schweitzer & Conrad, Inc., Chicago, Ill.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

SWITCHES, FIELD
I-T-E Circuit Breaker Co., Philadelphia, Pa.

SWITCHES, FUSE
General Electric Co., Schenectady, N. Y.
Kearney Corp., James R., St. Louis, Mo.
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MADE FROM SOLID BRASS ROD —

SCREWS HEAVILY RUST-PROOFED —

CATALOG NUMBER ON EACH PIECE

A complete line for stranded or solid wire in all sizes. All dimensions and proportions are held to accurate size. Ask for Bulletin No. 8.

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The Finished Cedar Pole

ROOFED—*and the roofs creo-stained* GREEN We are prepared to service your requirements promptly for our green rooted, accurately measured cedar poles. No extra cost for the outstanding V-C pole value. Let us quote on your needs now.

VALENTINE CLARK CORPORATION
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You will want to know how we solve the problem

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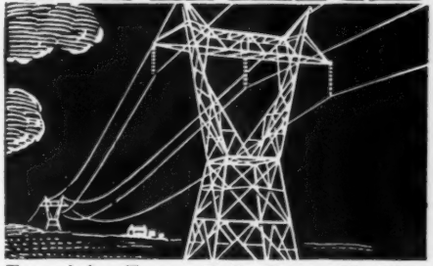
TRANSFORMERS

TOWERS



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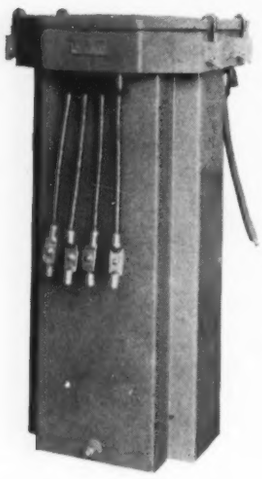
For Maximum Value per Dollar Investment



ADVANTAGES:

May be completely dismantled and reassembled with a wrench.

●

Coils vacuum impregnated in varnish—superior insulation to usual compounds.

●

Bushings of coordinated flash-over type—quickly replaced (no soldering) yet incapable of syphoning oil—splashproof and weatherproof.

●

Transformers are shipped filled with oil—leakage prevented by proper cover and pocket gaskets.

●

Tanks fabricated from copper-bearing steel—Covers cast from nickel-iron alloy — insurance against rust.

●

Coils of rugged design with low temperature gradient to provide proper cooling and additional overload protection.

AMERICAN TRANSFORMER CO.

Transformer Builders for over 33 years

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Kearney Corp., James R., St. Louis, Mo.
Pacific Elec. Mfg. Corp., San Francisco, Cal.
Railway & Industrial Engrg.Co.Greensburg,Pa.

SWITCHES, METER & ENTRANCE
General Electric Co., Schenectady, N. Y.
Metropolitan Device Corp., Brooklyn, N. Y.
Palmer Elec'l & Mfg. Co., Waltham, Mass.

SWITCHES, METER TEST
Meter Devices Co., Canton, O.

SWITCHES, OIL
Condit Elec'l Mfg. Corp., Boston, Mass.
General Electric Co., Schenectady, N. Y.
Line Material Co., South Milwaukee, Wis.
Pacific Elec. Mfg. Co., San Francisco, Cal.
South Bend Current Controller Co., So. Bend, Ind
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

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General Electric Co., Schenectady, N. Y.
Kearney Corp., James R., St. Louis, Mo.
Line Material Co., South Milwaukee, Wis.

SWITCHES, SAFETY
Cutler-Hammer, Inc., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Metropolitan Device Corp., Brooklyn, N. Y.

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Cramer & Co., Inc., R. W., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Landis & Gyr, Inc., New York, N. Y.
Mercoid Corp., Chicago, Ill.
Sangamo Electric Co., Springfield, Ill.

SWITCHES, TRANSFER
I-T-E Circuit Breaker Co., Philadelphia, Pa.

SWITCHGEAR, METALCLAD
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

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General Electric Co., Schenectady, N. Y.
Weston Elec'l Instrument Corp., Newark, N. J.

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Weston Elec'l Instrument Corp., Newark, N. J.

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Firestone Tire & Rubber Co., Akron, O.
Johns-Manville Corp., New York, N. Y.
Okonite Co., Passaic, N. J.

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General Electric Co., Schenectady, N. Y.

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Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

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Electric Controller & Mfg. Co., Cleveland, O.

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Firestone Tire & Rubber Co., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.

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Leach Company, Oshkosh, Wis.

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Crescent Tool Co., Jamestown, N. Y.
Graybar Electric Co., New York, N. Y.
Mathias Klein & Sons Co., Chicago, Ill.

TOOLS, LIVE LINE
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Safety Live Line Tool Co., Oakland, Cal.
Tips Tool Co., Inc., Taylorville, Ill.

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Bartlett Mfg. Co., Detroit, Mich.
Leach Co., Oshkosh, Wis.

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Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Co., Pittsburgh, Pa.

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American Transformer Co., Newark, N. J.
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General Electric Co., Schenectady, N. Y.
Kuhlman Electric Co., Bay City, Mich.
Moloney Electric Co., St. Louis, Mo.
Pennsylvania Transformer Co., Pittsburgh, Pa.
Uptegraff Mfg. Co., R. E., Pittsburgh, Pa.
Wagner Electric Corp., St. Louis, Mo.
Westinghouse E. & M. Co., E. Pittsburgh, Pa.

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International Harvester Co., Chicago, Ill.

TUBES, COPPER, BRASS, BRONZE & NICKEL SILVER
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Newport News Shipbuilding & Dry Dock Co., Newport News, Va.

TURBINES, MERCURY VAPOR
General Electric Co., Schenectady, N. Y.

TURBINES, STEAM
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Graybar Electric Co., New York, N. Y.
Line Material Co., South Milwaukee, Wis.

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Ohio Brass Co., Mansfield, O.

VALVES, GATE & BUTTERFLY
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.

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WATER WHEELS
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Newport News Shipbuilding & Dry Dock Co., Newport News, Va.

WELDERS, ARC
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland, O.
Ohio Brass Co., Mansfield, O.

WELDING RODS
American Steel & Wire Co., Chicago, Ill.
General Electric Co., Schenectady, N .Y.
Lincoln Electric Co., Cleveland, O.

WIRE
American Elec'l Works, Phillipsdale, R. I.
American Steel & Wire Co., Chicago, Ill.
Anaconda Wire & Cable Corp., New York, N. Y.
Copperweld Steel Co., Glassport, Pa.
Crescent Ins. Wire & Cable Co., Trenton, N. J.
General Cable Corp., New York, N. Y.
Graybar Electric Co., New York, N. Y.
Kerite Ins. Wire & Cable Co., New York, N. Y.
Okonite Co., Passaic, N. J.
Rockbestos Products Corp., New Haven, Conn.
Roebling's Sons Co., J. A., Trenton, N. J.
Simplex Wire & Cable Co., Boston, Mass.
United States Rubber Co., New York, N. Y.

WIRE, COPPER COVERED STEEL
Copperweld Steel Co., Glassport, Pa.
Crucible Steel Co. of Amer., New York, N. Y.

WIRE, GUY
American Steel & Wire Co., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Indiana Steel & Wire Co., Muncie, Ind.
Roebling's Sons Co., J. A., Trenton, N. J.

WIRE, MAGNET
Acme Wire Co., New Haven, Conn.
American Elec'l Works, Phillipsdale, R. I.
General Cable Corp., New York, N. Y.
General Electric Co., Schenectady, N. Y.

WIRE & RIBBON, RESISTANCE
Driver-Harris Co., Harrison, N. J.
General Electric Co., Schenectady, N. Y.
Hoskins Mfg. Co., Detroit, Mich.

WIRING DEVICES
General Electric Co., Bridgeport, Conn.
Pass & Seymour, Inc., Syracuse, N. Y.

SEARCHLIGHT SECTION

EMPLOYMENT : BUSINESS : OPPORTUNITIES : EQUIPMENT—USED or RESALE

UNDISPLAYED—RATE PER WORD:

Positions Wanted (full or part-time salaried employment only), 5 cents a word, minimum $1.00 an insertion, payable in advance.
(See ¶ on Box Numbers)

Position Vacant and all other classifications 10 cents a word, minimum charge $2.00.

Proposals, 40 cents a line an insertion.

INFORMATION:

Box Numbers in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

Discount of 10% if one payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

1 inch	$7.00
2 to 3 inches	6.75 per inch
4 to 7 inches	6.50 per inch
8 to 14 inches	6.25 per inch

Other spaces and contract rates on request.

An advertising inch is measured vertically on one column, 3 columns—30 inches—to a page. E. W.

COPY FOR NEW ADVERTISEMENTS RECEIVED UNTIL 10 A. M. MONDAY FOR SATURDAY'S ISSUE *(published every other week)*

POSITION VACANT

TECHNICAL MAN WANTED with experience to handle power promotion and sales work. Apply Post Office Box 114, Deal, N. J.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 25 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If you have actually earned over $2,500, send only name and address for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y. (E. W.)

POSITIONS WANTED

METER TESTER. Foreman, power and general utility experience. Also electrical construction, drafting, estimating, inspection. Age 30. W. Kilbury, Morris, Ill.

SUPERINTENDENT and engineer, wide experience on utility and industrial projects; design, construction, operation, maintenance, valuation. Several years' service on utility project South America. Desires new connection, United States, Mexico or South America. PW-310, Electrical World, 330 West 42d Street, New York City.

RADIO interference inspector, 7 years' electric utility experience in the location and elimination of all radio noises. Location immaterial. Excellent references. PW-311, Electrical World, 520 North Michigan Avenue, Chicago, Ill.

RELIABLE young man, 22, wants apprentice position in arc welding. Go anywhere. PW-312, Electrical World, 520 No. Michigan Avenue, Chicago, Illinois.

ELECTRICAL ENGINEERING

A BROAD, basic, intensive course for men of limited time, complete in one school year. Approved by educators, endorsed by industry. Modern buildings. 41 years' successful experience. Catalog on request.

BLISS ELECTRICAL SCHOOL
239 Takoma Ave., Washington, D. C.

POSITIONS WANTED

UTILITY EXECUTIVE. Eighteen years' finest experience all divisions electric light and power business—have enviable operating and management record including finest public relations. Graduate engineer; highest references; modest salary; available immediately. L. C. S., 502 Meacham Ave., Park Ridge, Illinois.

SALES ENGINEER, now employed, desires position with opportunity. Experience, six years resident agent for one of largest manufacturers of electrical equipment, two years commercial engineer for public utility. Age forty, married. PW-313, Electrical World, 520 No. Michigan Ave., Chicago, Ill.

AMERICAN engineer, university graduate, B.Sc.; age 41; twenty years with leading firms, specializing in analysis of markets for new business; thermodynamic work on air conditioning, mechanical transmission of power; desires connection. Can submit outline of experience; best references. PW-314, Electrical World, 330 West 42d Street, New York City.

WANTED

ANYTHING within reason that is wanted in the field served by Electrical World can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

U. S. Government

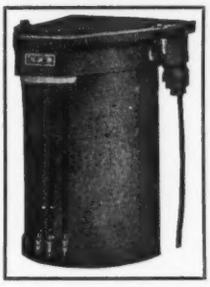
TREASURY DEPARTMENT, Procurement Division, Public Works Branch, Washington, D. C.—Sealed bids in duplicate will be publicly opened in this office at 10 a.m., Dec. 27, 1934, for furnishing all labor and materials and performing all work for the special interior lighting fixtures in the U. S. P. O., Minneapolis, Minn. Attention is directed to the special conditions of bidding set forth in the specifications, Executive Order No. 6646. In awarding the contract, consideration will be given only to manufacturers of lighting fixtures who have previously furnished and installed work comparable in all respects with that for which the bid is submitted, and who can, if so requested, show evidence that they have performed such work in a satisfactory manner. Drawing and specifications not exceeding one set, may be obtained by any satisfactory general contractor at this office in the discretion of the Assistant Director of Procurement, Public Works Branch. W. E. REYNOLDS, Assistant Director of Procurement, Public Works Branch. (171)

U. S. Government

TREASURY DEPARTMENT, Procurement Division, Public Works Branch, Washington, D. C.—Sealed bids in duplicate will be publicly opened in this office at 1 p.m., Jan. 4, 1935, for furnishing all labor and materials and performing all work for air conditioning, etc., at the U. S. P. O., Ct. H., Cu. H, Etc., Elkins, W. Va. The prevailing rate of wage shall be paid all laborers and mechanics employed on the project as provided in the Act of March 3, 1931 (Public No. 798), and executive orders of January 19, 1932, and No. 6646. No bid will be considered unless it includes or is accompanied by a certificate duly executed by the bidder stating that the bidder is complying with and will continue to comply with each approved code of fair competition to which he is subject and if engaged in any trade or industry for which there is no approved code of fair competition, then stating that as to such trade or industry he has become a party to and is complying with and will continue to comply with an agreement with the President Under Section 4 (A) of the National Industrial Recovery Act. Drawings and specifications may be obtained from the custodian of the building or at this office in the discretion of the Assistant Director of Procurement, Public Works Branch. W. E. REYNOLDS, Assistant Director of Procurement, Public Works Branch. (172)

TREASURY DEPARTMENT, Procurement Division, Public Works Branch, Washington, D. C.—Sealed bids in duplicate will be publicly opened in this office at 1 p.m., Jan. 3, 1935, for furnishing all labor and materials and performing all work for air conditioning, refrigeration, etc., at the U. S. Dept. Agri. Ext. Bldg. The prevailing rate of wage shall be paid all laborers and mechanics employed on the project as provided in the act of March 3, 1931 (public No. 798), and executive orders of Jan. 19, 1932, and No. 6646. No bid will be considered unless it includes or is accompanied by a certificate duly executed by the bidder stating that the bidder is complying with and will continue to comply with each approved code of fair competition to which he is subject and if engaged in any trade or industry for which there is no approved code of fair competition, then stating that as to such trade or industry he has become a party to and is complying with and will continue to comply with an agreement with the President under Section 4 (a) of the National Industrial Recovery Act. Drawings and specifications may be obtained from the custodian of the building or at this office in the discretion of the Assistant Director of Procurement, Public Works Branch. W. E. REYNOLDS, Assistant Director of Procurement, Public Works Branch. (173)

TRANSFORMERS



A Complete Stock. Prompt Shipment

4—750 KVA Pittsburgh Transformers, 60 cycle, 13,200—2200 Volts. **$1150.00 EACH**

We Rewind, Repair and Redesign all Makes and Sizes.

ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Write for Catalog No. 129-A

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M CINCINNATI, OHIO

FOR SALE

250 hp., 350 hp., 500 hp., and 600 hp., **B & W Steel Header Boilers, with stokers and all fittings.**

W. P. HEINEKEN, Engineer
95 Liberty Street, N. Y. Tel.—Barclay 7-7298

RE-NU-BILT BELYEA MOTORS

TRANSFORMERS SPECIALS

SINGLE PHASE, 60-CY., O.I.S.C.

Make	Type	Voltage
4—1000 kva. G. E.	OC	66,000-13,200/2300
6—500 kva. West.		2400-120/240
3—500 kva. G. E.	H	13,200-2300/4000 Y.
12—333 kva. Packard	A	13,200-2300
3—200 kva. G. E.	A	13,200/6600-2400
3—150 kva. G. E.	H	2300-230/115
2—150 kva. G. E.	H	2300-230/460
21—100 kva. Packard	A	2300-230/115
3—75 kva. G. E.	H	2300-230/115
3—37 ½ kva. West.	S	2400-120/240

MOTORS

3 PH., 60 CY.

Hp.	Type	Speed
675	Al. Ch. syn.	900
600	G.E. sl. rg.	257
600	G.E. syn.	257
450/360	West. sl. rg.	875/700
400	West. sl. rg.	514
300	Al. Ch. sl. rg.	585
260	Al. Ch. syn	720
200	West. sl. rg.	900
200	G.E. sl. rg.	900
200	G.E. syn.	900
150	West. sl rg.	720
150	G.E. sl. rg.	1750
100	Al. Ch. sl. rg.	685
80	G.E. syn.	1200
75	G.E. sl. rg.	690
75	G.E sl. rg.	900
60	G.E. sl. rg.	900
50	G.E. sl. rg.	1200
50	West. sl. rg.	1200

ENGINE GENER.

1-400 kva., Cr. Wh., 240 v., 3 ph. 60 cy. 120 r.p.m. to Hamilton Corliss Engine.

D. C. MOTORS

ADJ SPEED-230V

Hp	Type	Speed
500/250	G.E	500/375
100/200	G.E.	200/400
100	West.	365/600
80	Diehl	500/1100
75	West.	200/600
40	West.	300/900
35	El. Dy.	350/1050
27½	El. Dy	450/1350
25	West.	400/1200
25	West	650/2200
20	West.	375/1500
20	G.E.	650/1950
20	G.E.	500/1500
15	West.	400/1600
10/14	El. Dy.	300/1200
10	West.	500/1500
10	G.E.	600/1800

MOTOR GENER.

1-750 kw. G. E. MPC., 250 v., D.C. Gener. to 1100 hp. G. E., ATI, synch. motor, 2200-3-60-900 r.p.m.

Above are a few of our stock items.

BELYEA
COMPANY, INC.
151 WEST 18TH ST.
NEW YORK, N. Y.

SYNCHRONOUS MOTORS

150-hp. West., 3/60—600 r.p.m.
75-hp. Gen. Elec., 3/60—1200 r.p.m.
60-hp. Gen. Elec., 3/60—1200 r.p.m.
50-hp. Gen. Elec., 3/60—1200 r.p.m.
40-hp. Gen. Elec., 3/60—1200 r.p.m.
30-hp. Gen. Elec., 3/60—1200 r.p.m.
30-hp. 3/60— 900 r.p.m. Fynn-Weichsel.
25-hp. 3/60—1200 r.p.m. Fynn-Weichsel.
25-hp. 3/60— 900 r.p.m. Fynn-Weichsel.

L. J. LAND, 145 Grand St., New York, N. Y.

SYNCHRONOUS MOTOR

Electric Machinery Company 200 horsepower synchronous motor, 220-440 volt, 3-phase, 60-cycle, AC, 720 RPM, semi-automatic starter. Like new.

W. I. DENNY
618 W. Lake St., Chicago.

J. L. HEMPHILL & CO. Inc.
ELECTRICAL ENGINEERS AND EQUIPMENT
807 Williams St. North Bergen, N. J.
N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: PAlisade 6-2600

MOTOR GENERATOR SETS

1—500-kw., 250-V., Westinghouse Synchronous motor Generator Set.
1—250-kw., 230-V., 3-ph., 60-cy., 2300-4600 Synchronous Motor Generator Set.
1—200-kw., 230-V., 3-ph., 60-cy., 2300-4100-V. Synchronous Motor Generator Set.
1—150-kw., 600-r.p.m., 250-V. Gen., 3-ph., 60-cy., 220-440-V. G. E. Synchronous Motor.
1—125-kw., 250-V., Westinghouse Synchronous Generator Motor Set 3-ph., 60-cy., 230-2200-V.
2—125-kw., 125-V., G.E., 2300-V. motor.
1—100-kw., 125-V., D.C., 220-440 A.C. G. E. Synchronous Motor Generator Set.
1—100-kw., 250-V., Gen., 900-r.p.m., 220-V. Synchronous Motor.
1—50-kw., 230-V., 1200-r.p.m., 220-V. Westinghouse Synchronous Motor.

ENGINE GENERATOR SETS

2—200-kva. 220/440/600/2300-V. General Electric Ames Uniflow.

TURBINES

1—1500-kva. 3-ph., 60-cy., 2300-V., Condens. West.
1—750-kw., 3-ph., 60-cy., 480-V., Non-Condens., West.
1—475-kva. Westinghouse Non-conden.

TRANSFORMERS

3—333 kva. Pittsburgh, 7500/15000/230/460-v.
4—333-kva. Pittsburgh, 4100/110/220-V.
6—200-kva. G. E., 2400/120/240-V.
4—150-kva. Westinghouse, 2400/120/240-V.
3—100-kva. Westinghouse, 2400/120/240-V

A. C. GENERATORS

No.	Kw.	R.p.m	Volts	Ph	Type
1	125	900	2300	3	Cr.-Wh.
2	100	900	230–2300	3	G.E
1	75	600	220	3	Westg.
1	75	900	2300	3	G.E.
1	50 Kva.	450	220/440	3	Diehl

MOTORS—3 phase, 60 Cycle

No.	Hp.	R.p.m.	Volts	Type
1	1000	400	Any Voltage, sl. rg.	
1	800	180	4000	Westghse. Syn.
1	500	150	2300	Elec. Mach. Syn
1	500	900	440/4000	Westghse. Syn.
1	500	720	4100	G. E., sl. rg.
1	500	450	2200	G. E., sl. rg.
1	350	900	2200 '4000	Wh. Syn.
1	250	600	2200/4000	G. E. syn.
1	250	600	440–2200	G. E. syn.
3	200	450	2300/4100	G. E., sl. rg.
2	200	600	440	G. E., sl. rg.
1	150	360	2300	Allis Chal., Syn.
3	200	514	4150–2300	G. E. syn.
2	200	514	2300–4000	G. E. sl. rg.
2	150	1200	220/440	Westg. sl. rg.
1	150	900	2200	G. E. Syn.
2	150	514	2200	Westgh., sl. rg.
1	150	1800	2200	West. sq. cg. mfr.

PUMP

1—4,000,000 gal. Water Pump Worthington engine.

FREQUENCY CHANGER

1—100-kw., 750-r.p.m., General Electric.

Complete Line of A.C. and D.C. Motors and Generators

STEPHEN HALL & CO.
Incorporated
7th and Adams St's. Hoboken, N.J.

SLIP RING MOTORS
3-PH., 60-CY.

HP	Volts	Make	Speed
700	2300	G.E.	900
200	440–220	G.E.	600
150	2200–440–220	G.E.	514
150	2200–220–440	G.E.	720
150	220–440–550	G.E.	600
100	220–440	G.E.	600
100	2200–440–220	Westghse.	1200
100	550	Wagner	720
100	2200–550	Westghse.	900
100	440–220	G.E.	720
100	550	G.E.	900
100	220–440	G.E.	900
75	440–220	G.E.	900
75	220–440	G.E.	720

SYNCHRONOUS MOTORS
3-PH., 60-CY.

300	220–440	G.E.	600
240	2200–440–220	G.E.	600
220	220–440	G.E.	720
172	2200–440–220	G.E.	720
120	440–220	G.E.	900

A. C. GENERATORS

1—250 kva., 600 r.p.m., 240-480-V., G.E.
1—225 kva., 600 r.p.m., 2200-240-480-V., G.E.
1—112 ½ kva., 1200 r.p.m., 2300-240-480-V., G.E.
1—112 ½ kva., 900 r.p.m., 240-480-V., G.E.
1—50 kva., 1200 r.p.m., 2300-480-240-V., Whse.
1—37 ½ kva., 1200 r.p.m., 480-240-V., G.E.
1—30 kva., 1200 r.p.m., 2300-480-240-V., Whse.

MOTOR GENERATOR SETS

1—200-kw., 250-V., 1200 r.p.m., Reliance con. to El. Mach. 2400/4150-V., 60 cy. syn. motor.
1—150-kw., 250/125-V., 1200 r.p.m., G.E. type M.P.C., con. to A.T.I. 230 hp., 220/440-V., 60 cy., syn. motor.
1—50-kw., 125-V., 1200 r.p.m., Reliance con. to El. Mach. 2300/440/220 V. syn. motor.
1—50-kw., 250-V., 1200 r.p.m., G.E. RC con. to KT, 75 hp., 220/440 V. motor.
1—15-kw., 125-V., 1800 r.p.m. G.E. RC con. to KT motor.

DIRECT CURRENT MOTORS

HP	Volts	Make	Type	Speed
250	230	G.E.	MPC	700
200	230	G.E.	RC	800
125	230	G.E.	RC	850
100	230	Westghse.	SK	625
100	230	G.E.	LC	1150
80	230	G.E.	RC	600
75	230	G.E.	RC	950
50	230	G.E.	CD	1150

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
150	2200–440–220	G.E.	I-K	720
150	550	G.E.	KT	720
100	550	G.E.	KT	900
100	440–220	G.E.	I-K	720
100	220–440	G.E.	KT	900
75	220–440	G.E.	KT	720
75	2200	Westghse.	CS	1800
60	220–440	Westghse.	CS	1800
50	4000–2300	G.E.	I-K	900

TRANSFORMERS
60 CYCLE

3—500 kva., G.E. type H-KDD 13200-2300/4000 Y.
9—333 kva., Packard (Allis Chalmers) type A 13800-2300/4000 Y.
3—250 kva., G.E. type H-KDD 13800-230/460.
3—250 kva., G.E., type H-KDD 4800/2400-480/240.
2—200 kva., G.E. type H-KS 2300/4000 Y-230/115.
2—200 kva., G.E. type-KS 2300-230/460.
3—150 kva., G.E. type H-KDD 2300-230/115.
3—150 kva., Allis Chalmers 6900/13800-220/440.
22—100 kva., Packard (Allis Chalmers) type A 2300/4000 Y-230/115.
3—75 kva., Pittsburg 2300/6900-230/460.
3—75 kva., Whse. type SKA 2300-230/115.
1—75 kva., G.E. type H-KS 4800/2400-240/208/120.
3—50 kva., G.E. type H-K 2200-220/110.

WHICH DO YOU PREFER?
CASH—IDLE EQUIPMENT

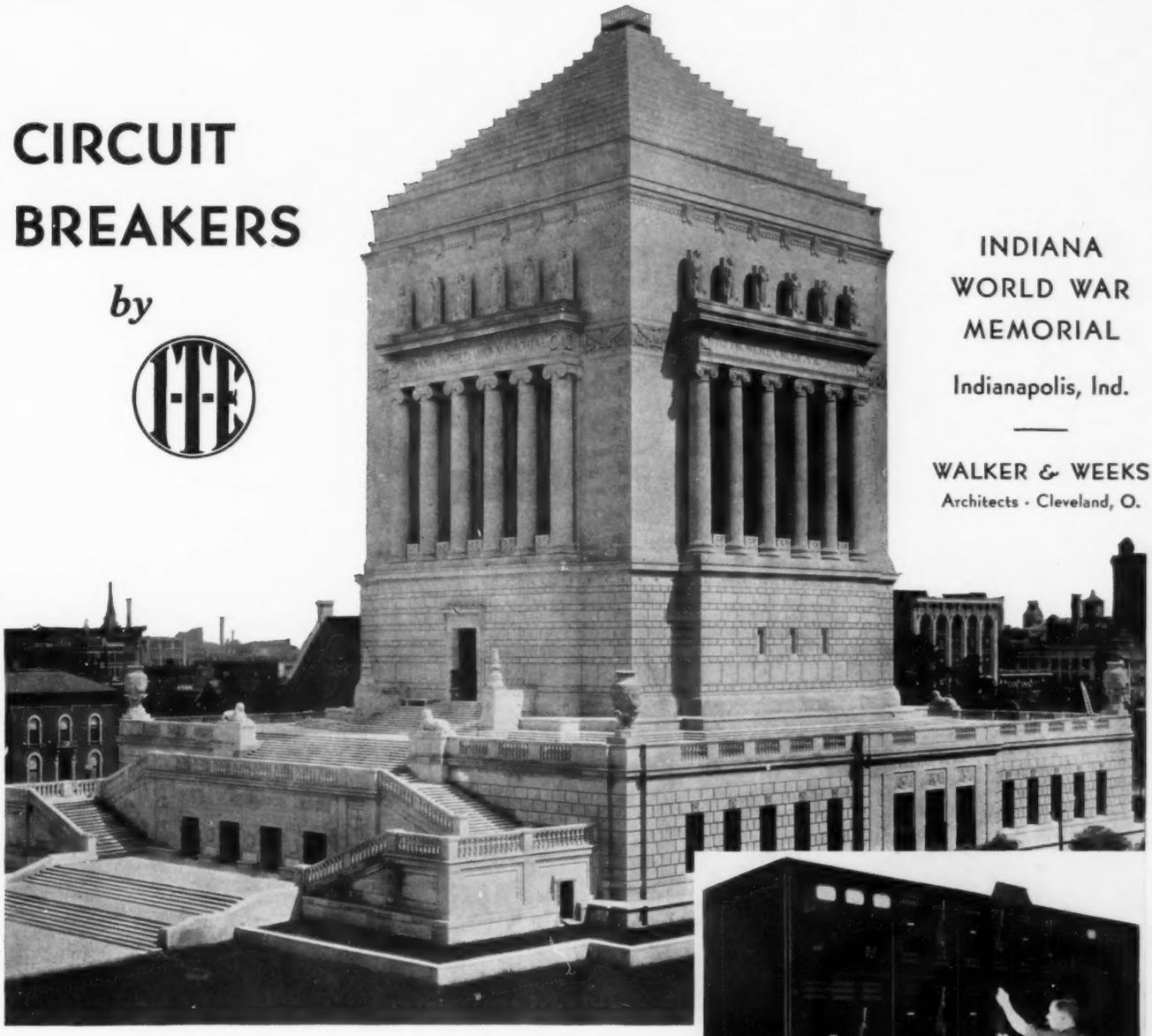
That surplus USED EQUIPMENT you have can be turned into CASH. The fact that it is of no further value to you doesn't mean it isn't of value to somebody else. There's always a market for good used equipment. Reach the greatest number of prospective buyers, at a minimum cost through the

SEARCHLIGHT SECTION

CIRCUIT BREAKERS

by

I-T-E



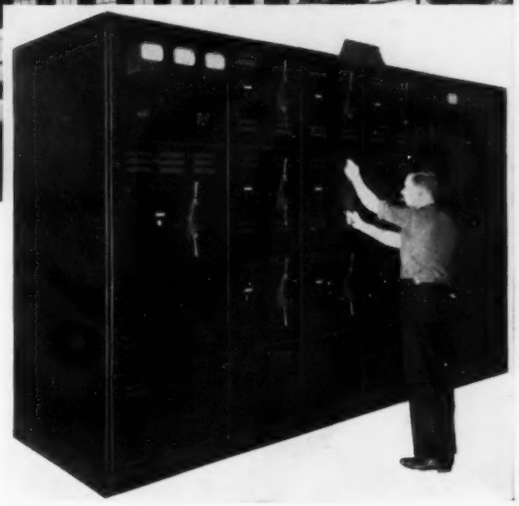
INDIANA
WORLD WAR
MEMORIAL

Indianapolis, Ind.

WALKER & WEEKS
Architects · Cleveland, O.

THE Central Shrine of the Indiana World War Memorial takes its place among the monuments of the world. It is Indiana's everlasting symbol of tribute to the heroism of their World War dead. Second to none in awe inspiring beauty, it complements the nearby Soldiers and Sailors Monument and makes Indianapolis a twice-over Monumental City.

In accordance with the modern trend in design of memorials, provision is made for the housing of civic and patriotic activities in this building. Electric power for lighting, elevators, ventilation and auxiliary service is provided with proper protection, through the use of I-T-E Air Circuit Breakers incorporated in a steel enclosed dead front Multumite switchboard. No selection of electrical protection could have secured more in "fool-proof" operation, enduring safety, low maintenance and lasting service.



ELECTRICAL ENGINEER
CLYDE H. LOUGHRIDGE—Cleveland, Ohio

ELECTRICAL CONTRACTOR
HATFIELD ELECTRIC CO.—Indianapolis, Ind.

SWITCHBOARD MANUFACTURER
CLEVELAND SWITCHBOARD CO.—Cleveland, Ohio

Speaking of *by lines,* circuit breakers are usually—*by I-T-E*

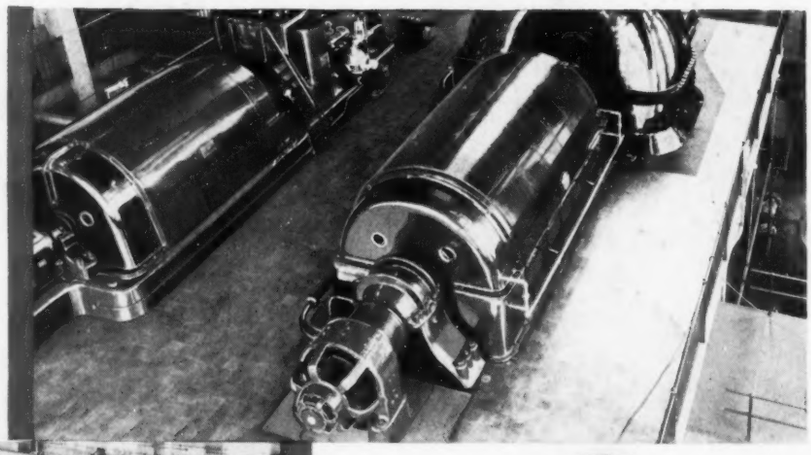
I·T·E CIRCUIT BREAKER COMPANY

19TH AND HAMILTON STS., PHILADELPHIA, PA.

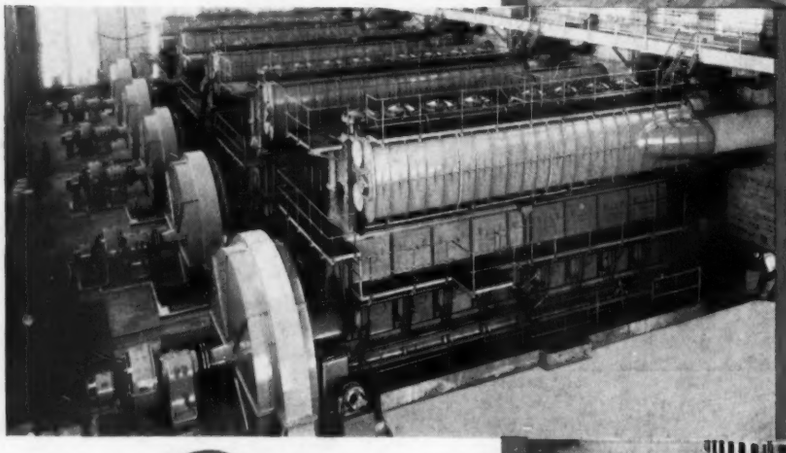
UNIV OF MICHIGAN
GENERAL LIBRARY
ANN ARBOR MICH

MORE POWER *at less cost*

STEAM STATIONS



Texaco Regal Oils are *tested* lubricants known the world over for their remarkable resistance to sludging and emulsification. They are exceptionally pure, long lived and uniform. They are dependable and economical for all conditions.

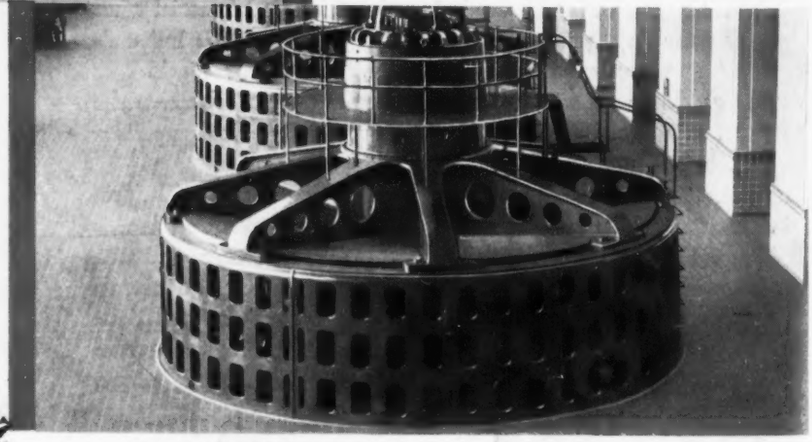


DIESEL STATIONS

Texaco Ursa Oils make for freer rings and lower fuel consumption. Their exceptionally low carbon content reduces overhaul and maintenance expenses. America's largest Diesels use them to maintain peak efficiency — low operating costs.

HYDRO STATIONS

Texaco Regal Oils are used by the largest hydro station in this country. The dependability of these *tested* lubricants has been *proved* again and again over a period of twelve years. They meet every demand with efficiency and economy.



NRA CODE

THE TEXAS COMPANY • 135 East 42nd Street, New York City

TEXACO *tested* LUBRICANTS

"There is a Texaco tested Lubricant for every purpose"